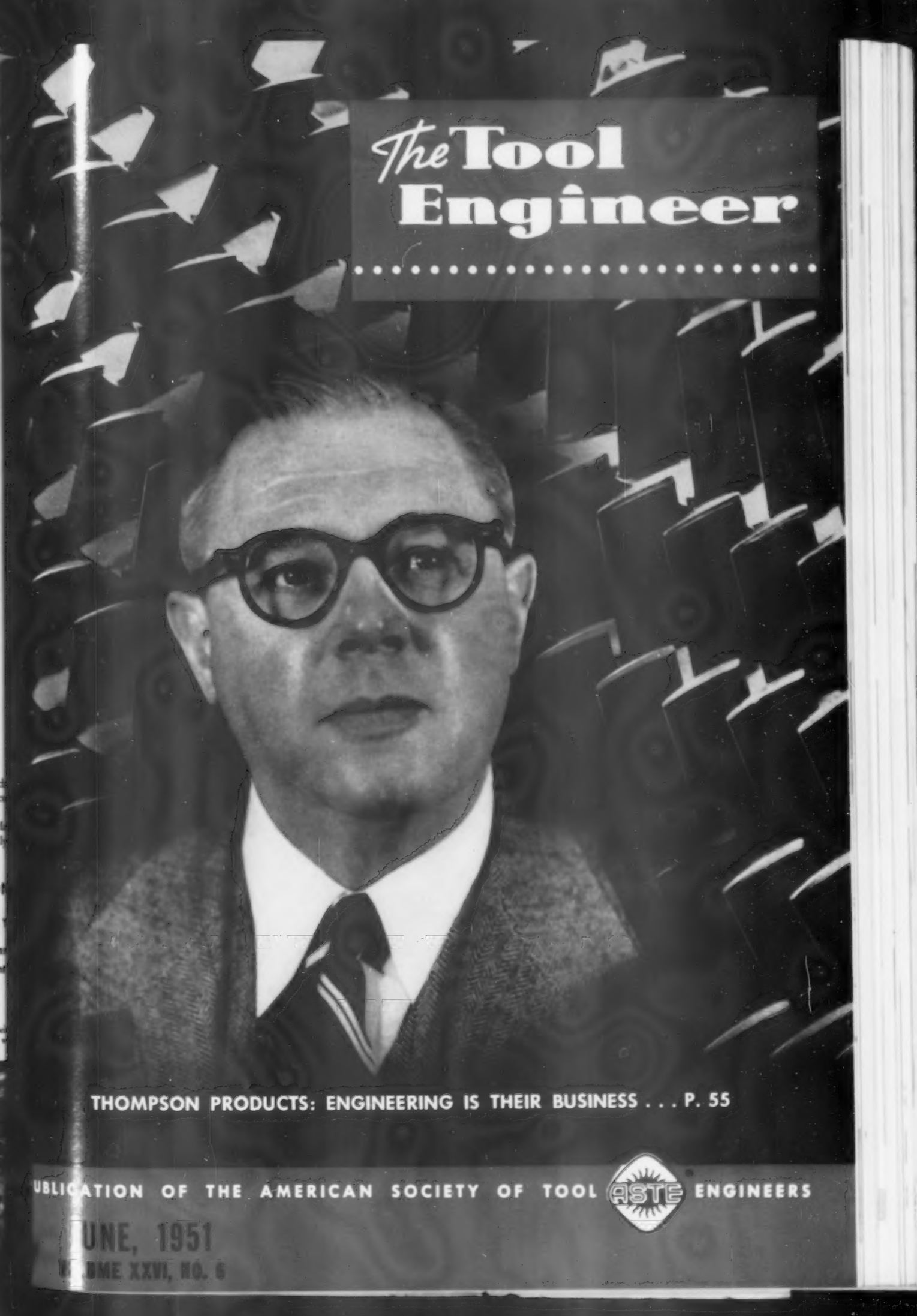


The Tool Engineer

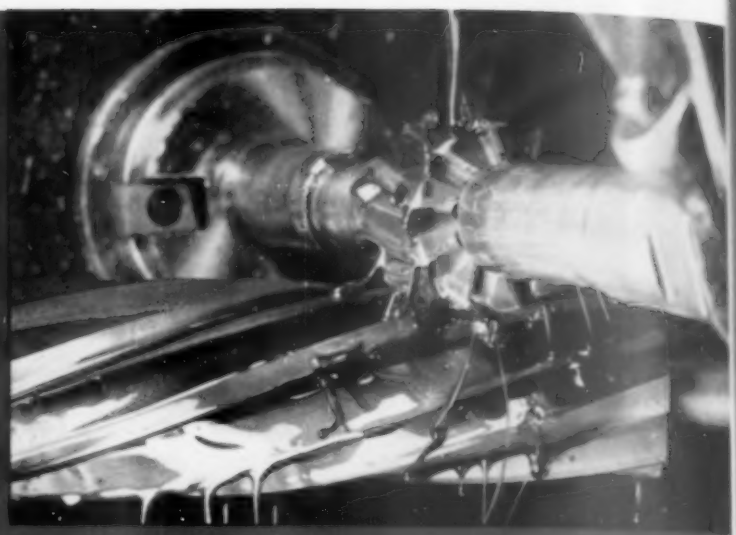
THOMPSON PRODUCTS: ENGINEERING IS THEIR BUSINESS . . . P. 55

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

JUNE, 1951

VOLUME XXVI, NO. 6

PRATT & WHITNEY MILLING CUTTERS



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P&W MILLING CUTTERS
—important factors in today's Production for Defense

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VOLUME X
NUMBER 6
JUNE, 1951

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AMERICAN SOCIETY OF TOOL ENGINEERS

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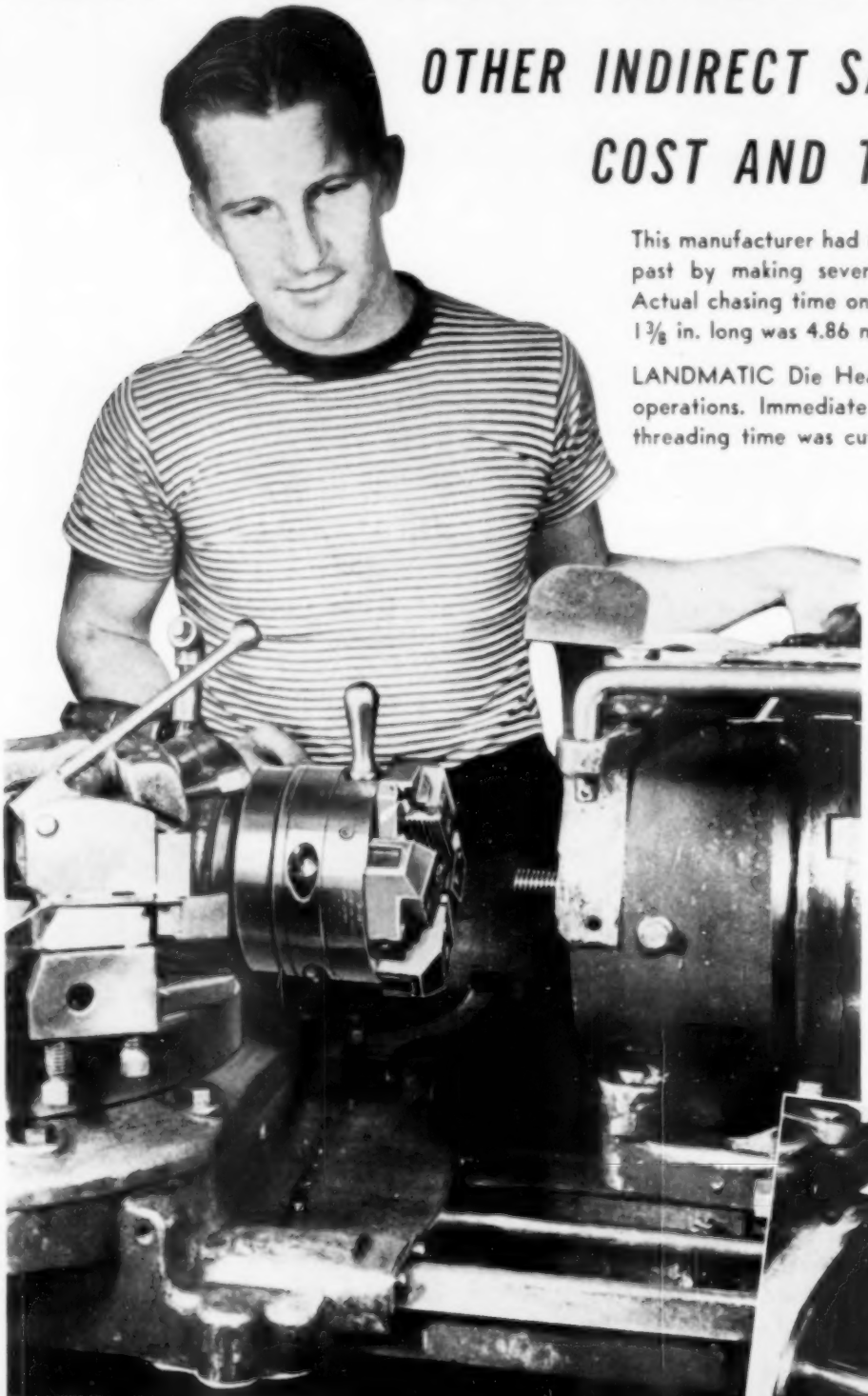
Now... 36 Pieces Threaded Instead of 1

OTHER INDIRECT SAVINGS IN TOOL COST AND TOOL INVENTORY



This manufacturer had cut threads on adjusting screws in the past by making several passes with a single point tool. Actual chasing time on the .623 in. diameter 8 pitch thread 1 3/8 in. long was 4.86 minutes.

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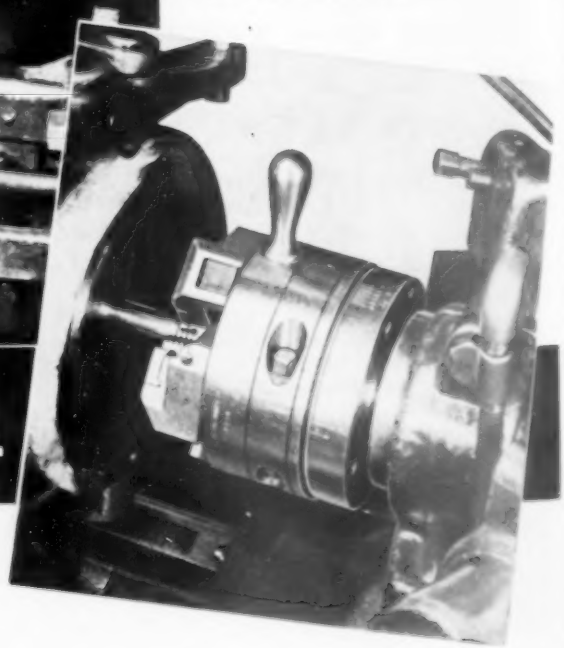

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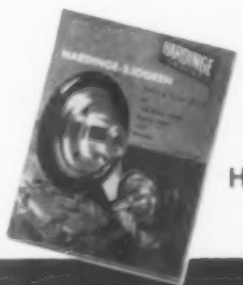

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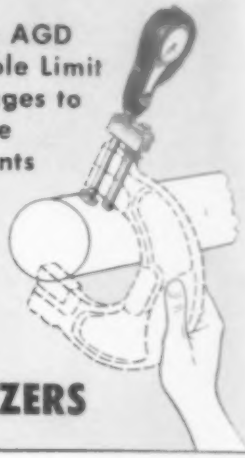

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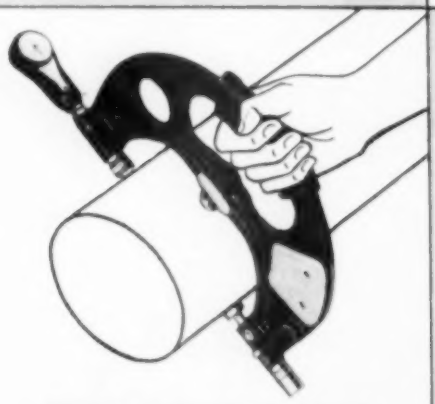
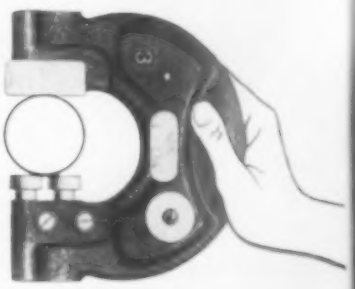


DIAL SNAP GAGES

DIAL COMPARATORS



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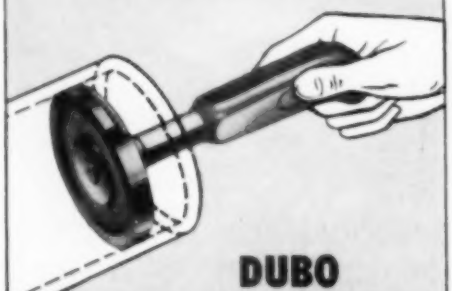

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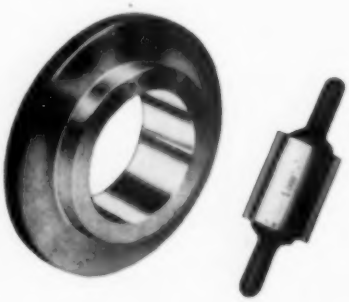

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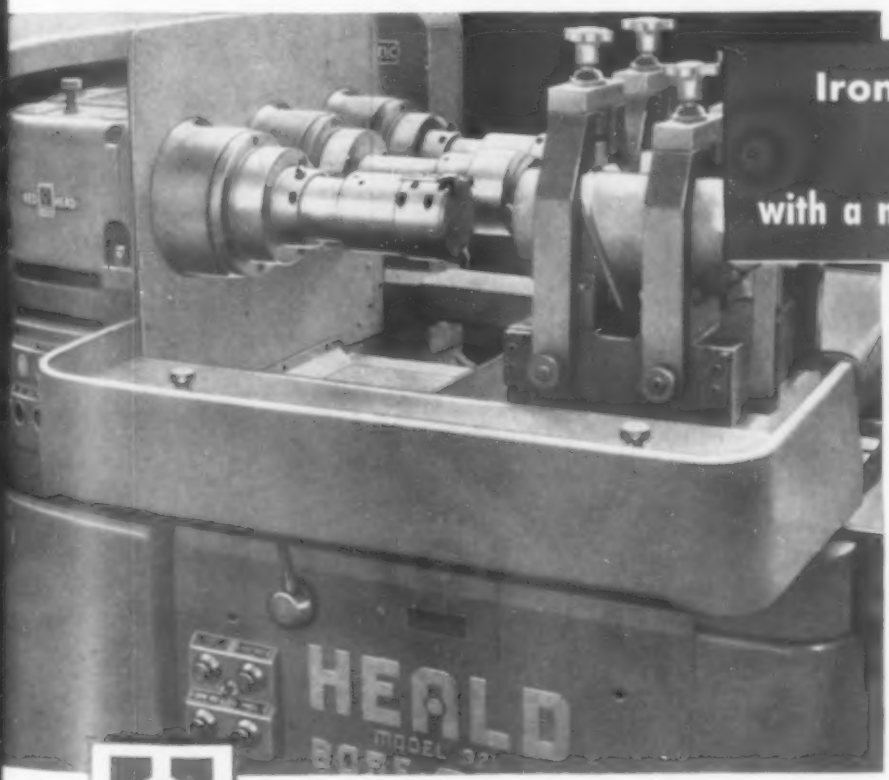

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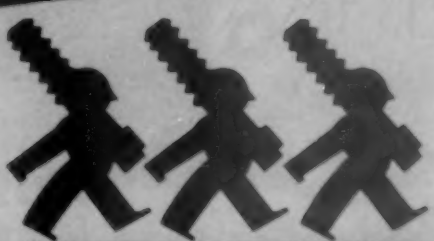

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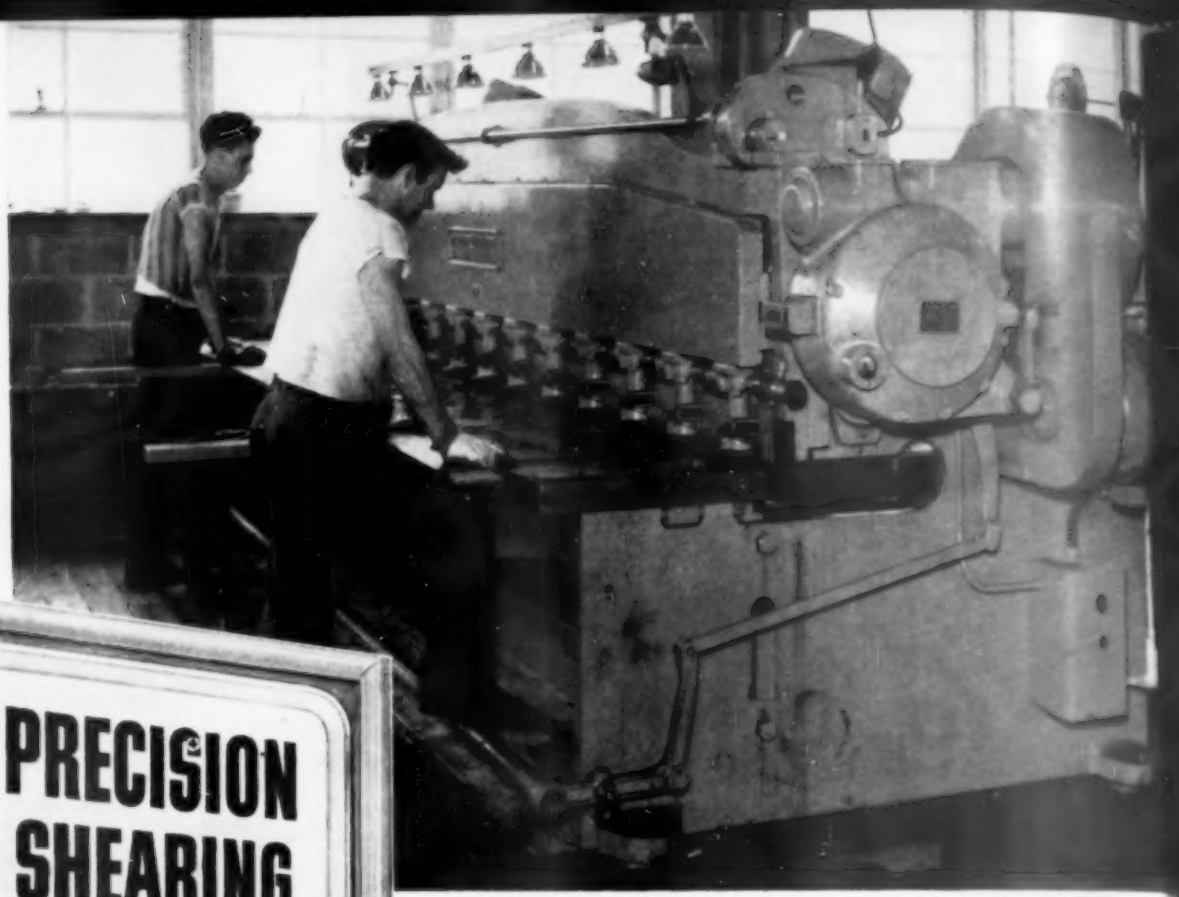

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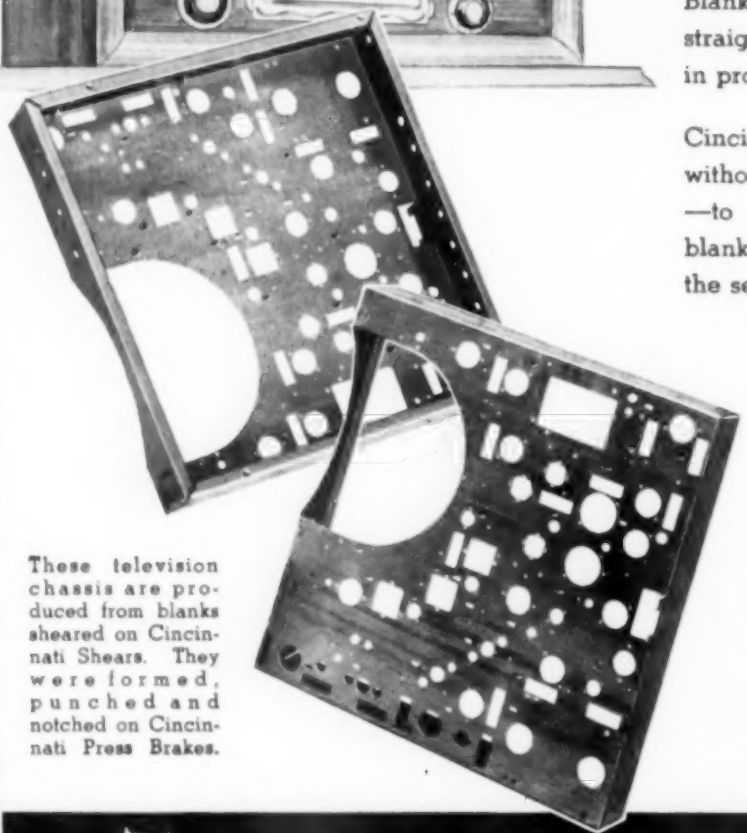

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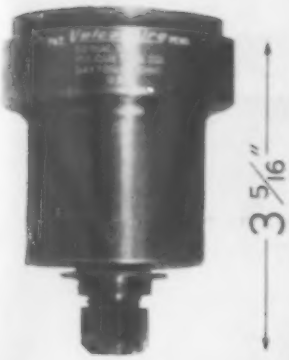

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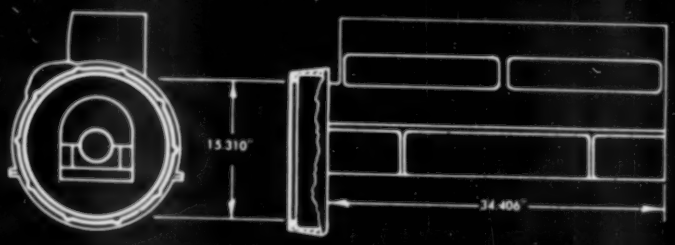

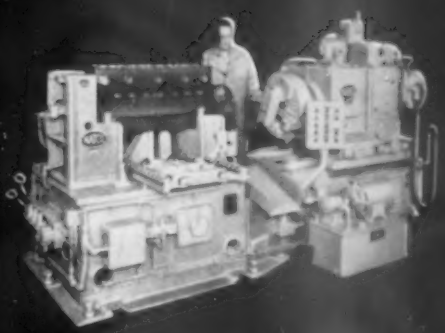

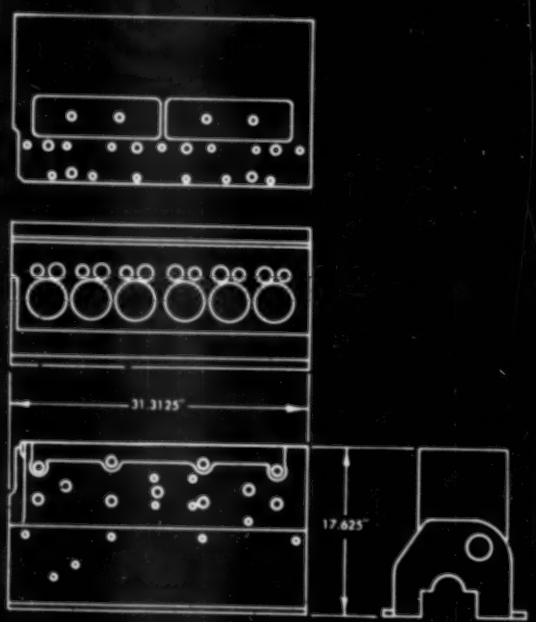

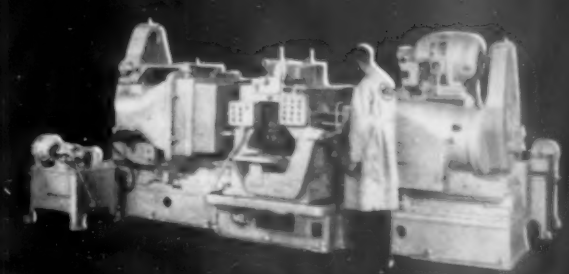

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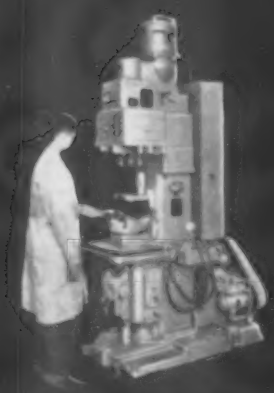

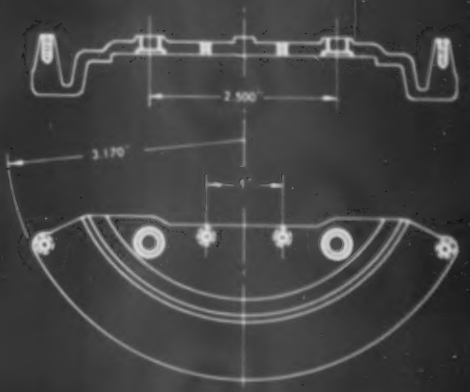

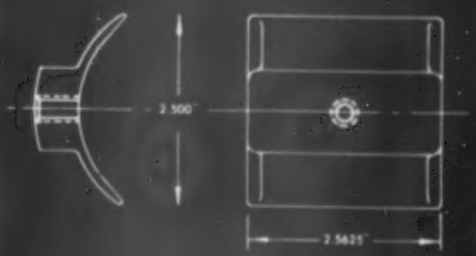

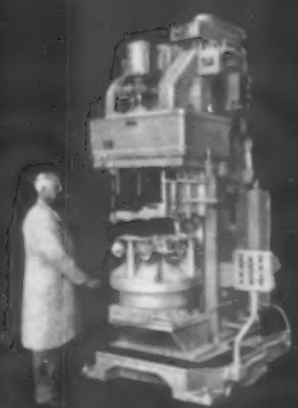

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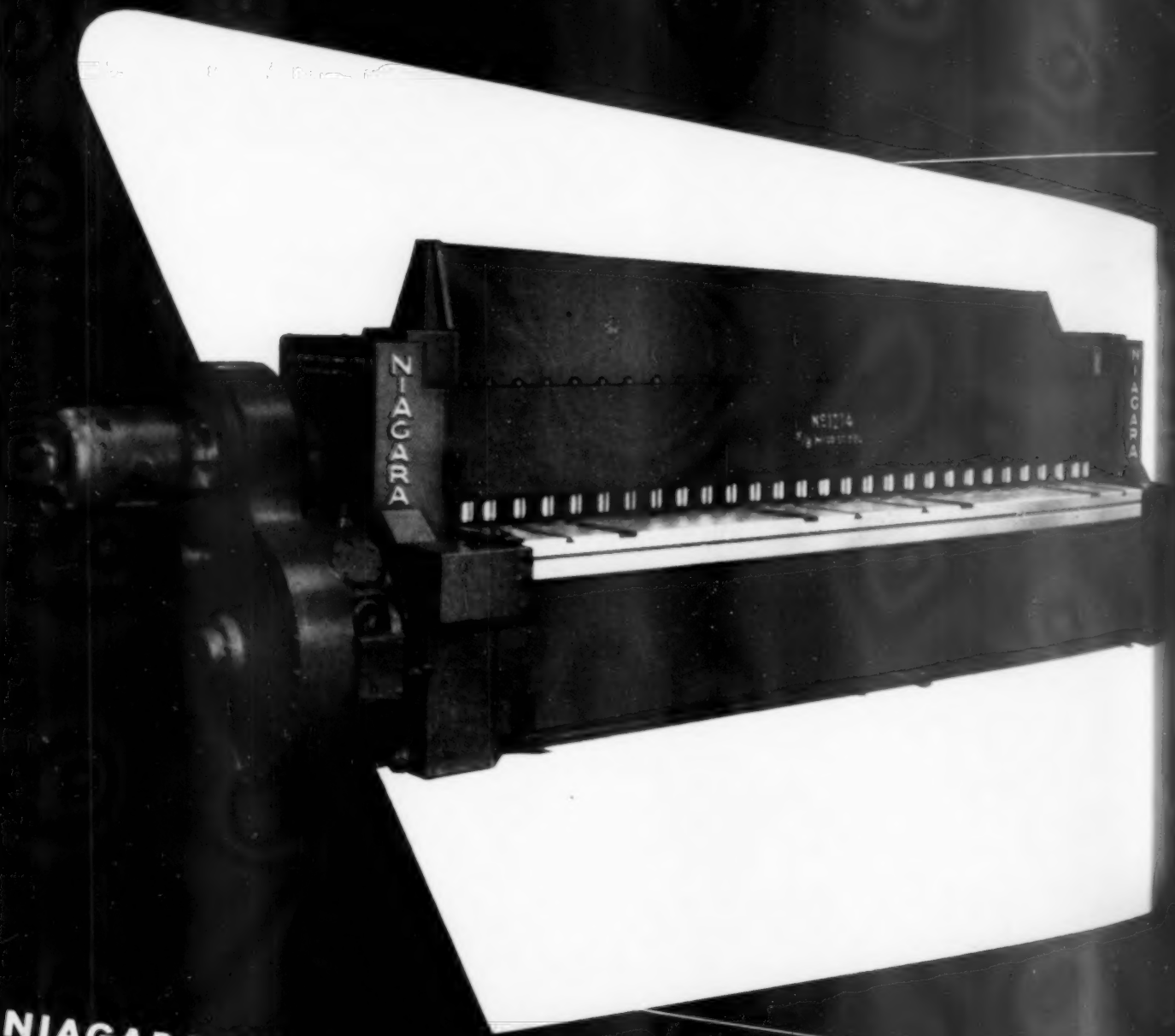

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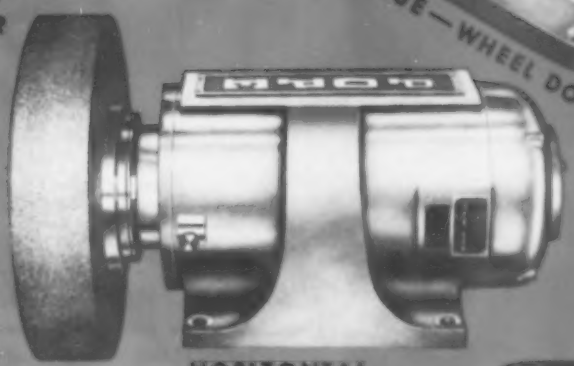
OBLIQUE—WHEEL UP

OBLIQUE—WHEEL DOWN



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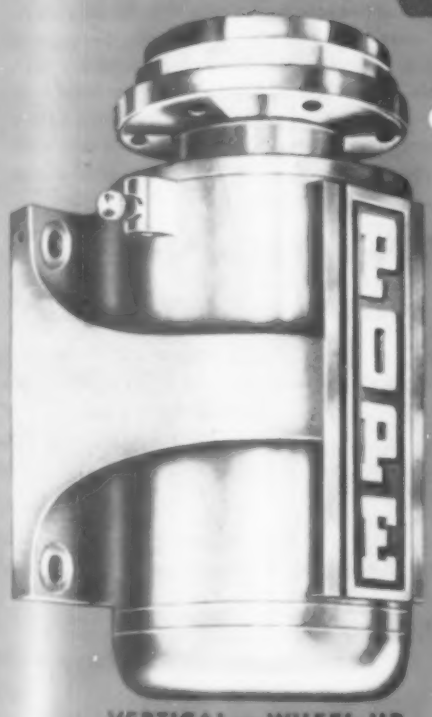

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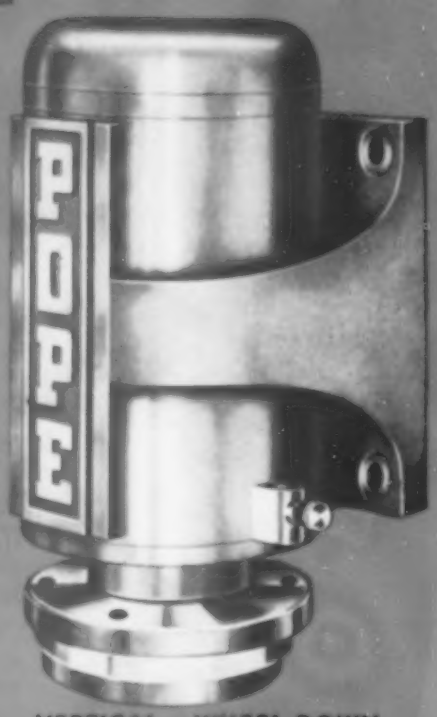
It is necessary, however, that the operating position be specified in your order.



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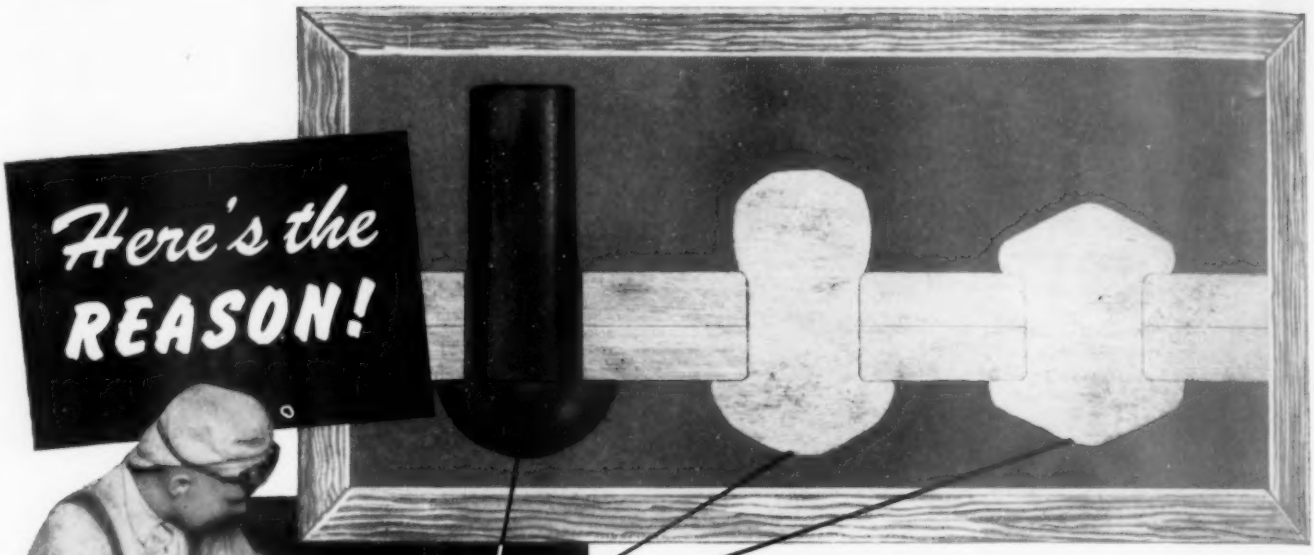
Why Does the HANNIFIN "Silent Squeeze" Method of COLD RIVETING Offer —

SUPERIOR STRENGTH?



HOW HANNIFIN FORMS A RIVET

The above photograph shows steps in the Hannifin "Silent Squeeze" Method of cold forming a modified cone head rivet with hydraulic pressure. Left, the original rivet. Center, head partially formed. Right, the completed rivet shown in cross-section. Note how the shank swells under pressure*, completely filling the hole. Under this cold flow, a slight fillet forms under the driven head, increasing its strength. The preformed button head is often reshaped to conform to the appearance of the modified cone head.

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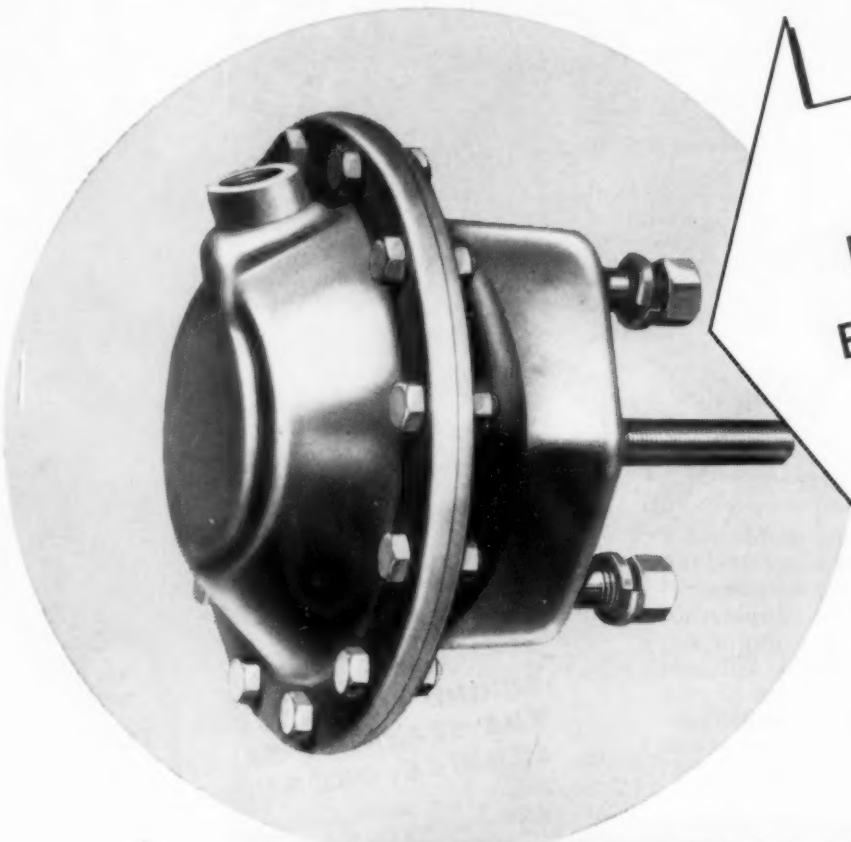

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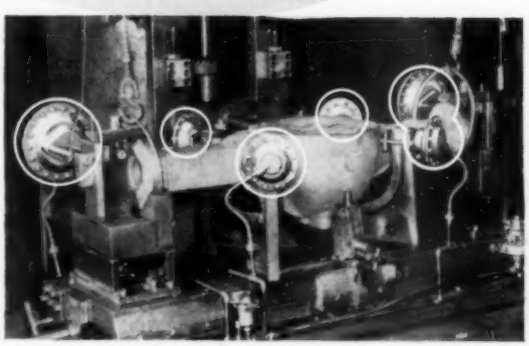

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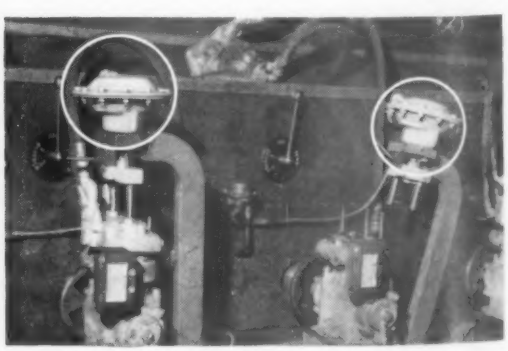

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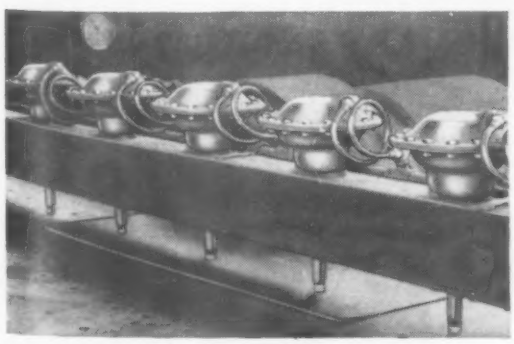

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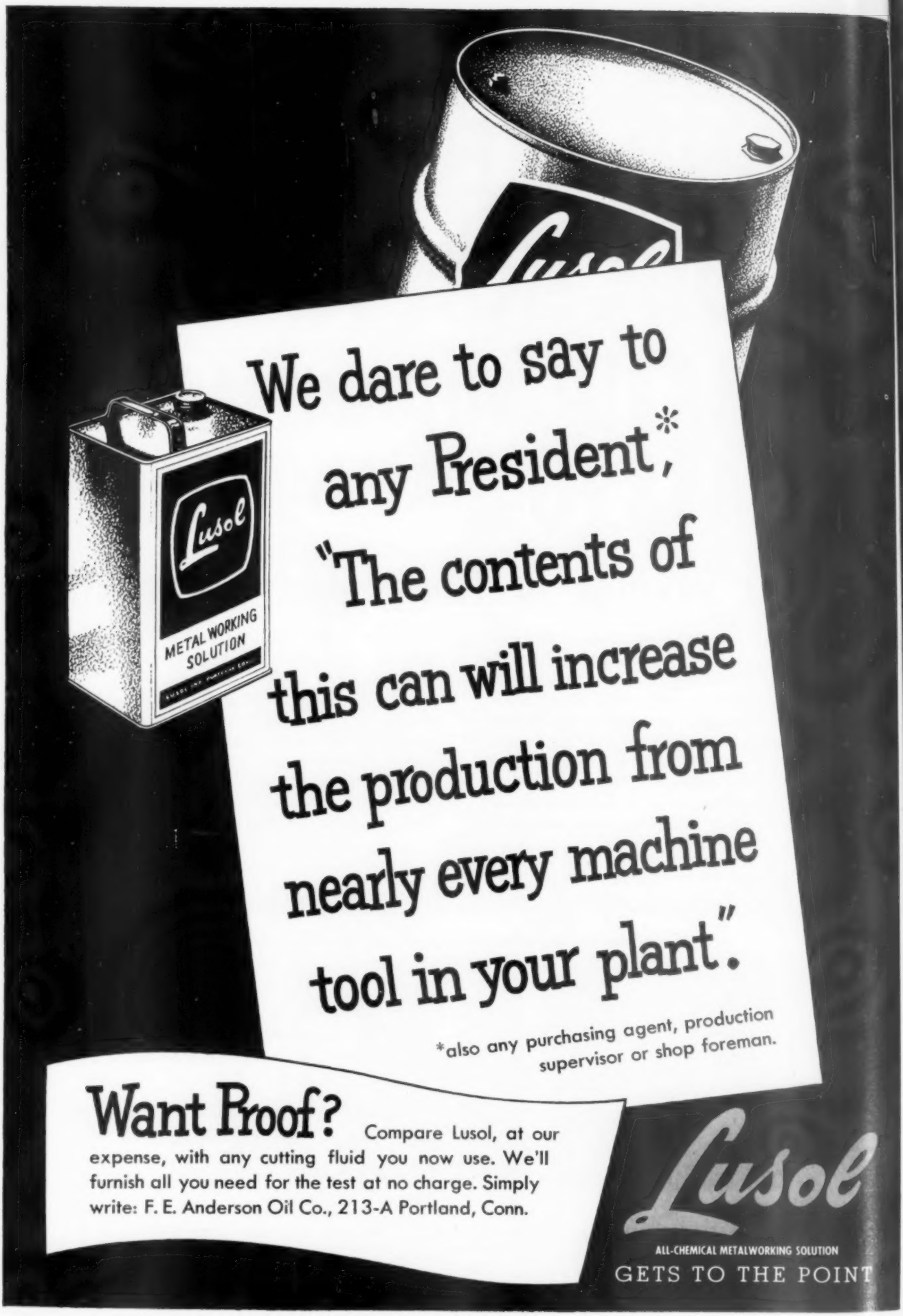
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THE TOOL ENGINEER

Publication of The American Society of Tool Engineers

The Tool Engineer

a Letter from the Editor...

This month a letter is going out from A. E. Rylander, technical editor of *The Tool Engineer*, to all chapter chairmen to enlist the aid of all of ASTE's many chapters in an important new project.

Conversion of plants to defense activity has tremendously increased the number of requests *The Tool Engineer* and ASTE receive for specific tooling and production data on new processes and materials, and on special applications of current techniques which tie into new developments in planes, tanks, guns and shells.

We as a body are in an excellent position to perform a great service for industry at large. Since our membership is so diversified in type of work, and because of our large numbers, a pressing problem on the mind of one tool engineer is likely to be a job which several others in the Society have had to solve in the past. A tooling kink which may have been standard practice in your plant for years may well be the only solution to a difficult problem in an entirely different industry.

This, of course, is only repeating the basic aim of our Society—to provide an interchange of information among members which will advance the science of tool engineering.

And Mr. Rylander's letter outlines a method which, with your help, will enable ASTE to tap a treasurehouse of knowledge which will not only be of some help to every member, but in addition represent a Society contribution to industry and government. The plan in essence is to ask for at least one volunteer in every chapter who will periodically report to headquarters on new developments in tool engineering in his area.

The reports, channeled through *The Tool Engineer* offices, will provide the Society as a whole with the latest practical data on all phases of tool engineering through publication in *The Tool Engineer* and presentation before national and chapter meetings.

Your help is vitally needed to make this effort a success and at the same time make it pay future dividends for you. If we can count on you in this campaign to find the best in tool engineering practice, I would suggest that you either contact your chapter chairman, or write direct to Mr. Rylander or myself for details.

Gilbert P. Muir

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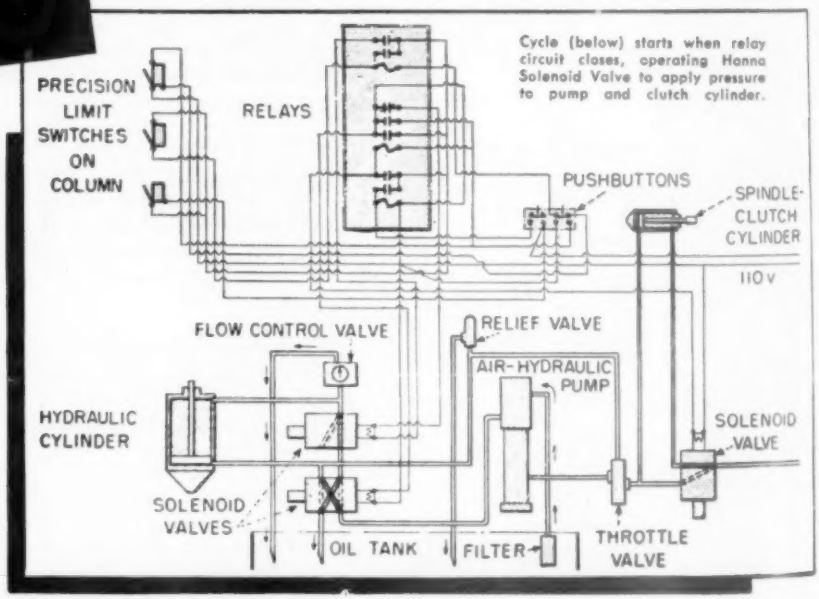

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The Tool Engineer

Editorial

Sound Guidance Can Insure a Sound Investment

STOCKPILING NEEDS, greater armament demands as well as increased consumer demand are combining in our economy to make conservation of critical metals and alloys an important key to building up a war machine and maintaining civilian output.

Conservation of materials can take two forms: industry can simply cut production of non-essential items to insure a supply for the services, or it can develop substitute materials which are in better supply.

The matter of substitutes was a major problem during the last world war. As materials became more and more scarce, companies found acceptable substitutes the only answer to the alternative of shutting down production on civilian goods. And it became more and more obvious that in many cases, substitute materials well-engineered to the application had passed the probationary status of temporary measures—they reflected enough advantages in cost, product life, appearance or ease of manufacture as to remain after the war.

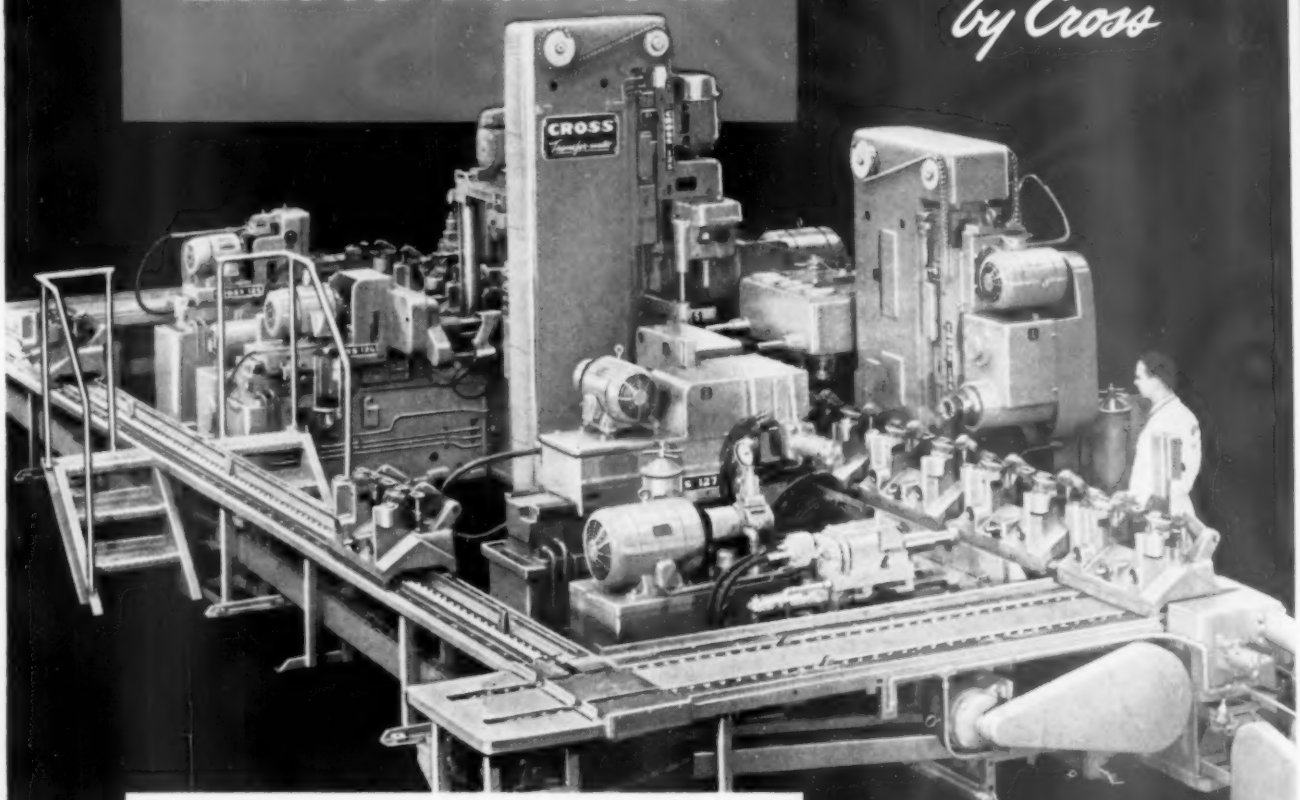
Our explanation of success in some cases, failure in others, is properly engineered research and development. Basic research on some untried, perhaps not-too-well-known materials; applied research and development to learn what the material would do for a particular product and then work it into that product.

This is another of ASTE's services to industry. ASTE's research foundation, set up for this type of service, can channel the manufacturer's aims to an economically sound decision. Working through ASTE the manufacturer will learn that substitutes are not necessarily temporary measures.

J. J. Demuth

Mills, Drills, Bores, Reams, Chamfers and Taps Exhaust Manifolds

Another Transfer-matic by Cross



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Hobs and Hobbing in High Production

By A. D. Moncrieff and Harry Pelphrey

ASSISTANT CHIEF ENGINEER RESEARCH ENGINEER

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THE MANNER IN WHICH a cutting tool removes chips, the effectiveness with which it removes those chips, what kind of chips it removes, the accuracy with which it removes them, and the work that each part of the tool has to do in removing those chips are the gages by which the productive value of any tool can be measured.

In the investigation of single thread versus multiple thread hobs, a number of considerations are involved. First of all, we know by experience that multiple-thread hobs require rigid machines kept in good repair. Obviously any findings which assume the use of such equipment would not necessarily hold true if the equipment did not meet these specifications.

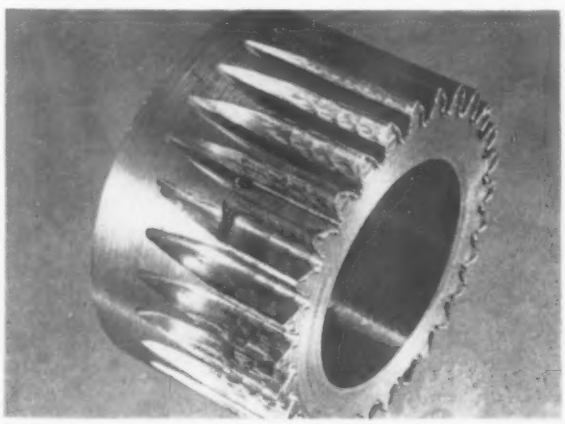
Next we assume that hobs will be accurately made and maintained and will be of proper design for the job. Since multiple-thread hobs have fewer teeth in contact with the gear than single-thread hobs of the same number of flutes, the multiple-thread hob should be sufficiently larger in diameter to enable us to increase the number of flutes. If the same number of flutes were used for both single and multiple-thread hobs, a rougher finish would obviously be produced with the multiple thread. Also, there would be a different set of conditions regarding chip removal.

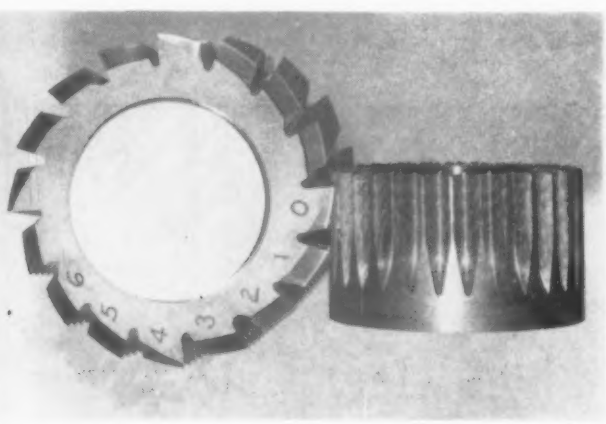
Next, the number of teeth being hobbed is to be considered, keeping in mind that a gear or spline with a relatively small number of teeth, say 12 or less, indexes very rapidly when using multiple-thread hobs, which would necessitate a reduction in the rpm of the hob to stay within machine capacity.

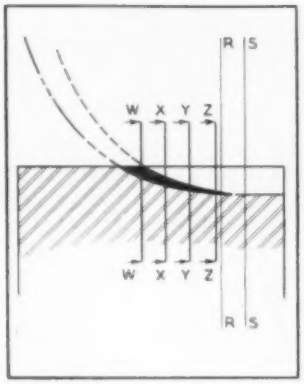
With these factors in mind, we selected for study a 29-tooth spur gear with 27½ deg pressure angle. This gear was in actual production, using a four-thread hob, and the equipment readily adapted it-

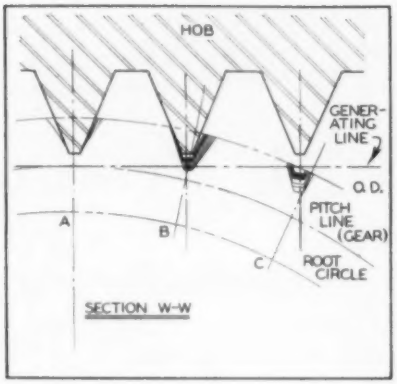
Presented at Annual Meeting, American Society of Tool Engineers, March 15, 1951.

Gear in Fig. 1, left, has been climb-hobbed with a single-thread hob. Shows point in cutting cycle where the hob action is stopped for study. Fig. 2, at right, pictures the hob position in relation to the gear at the point where chip formation is analyzed.









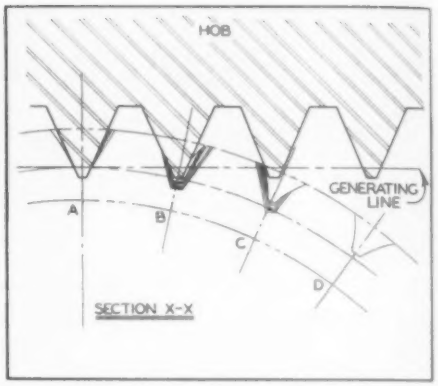


Fig. 3, left, shows pattern for chip removal cycle, while Fig. 4, center, and Fig. 5, right, show particulars of work as hobbing progresses. Drawings show position of teeth as they contact gear. Note increase indicated in depth of cuts indicated by darkened areas as work travels from Fig. 4 to Fig. 5.

self to the use of a single-thread hob to check the analytical findings.

The findings on this one gear do not of themselves provide the answers to all multiple-thread hobbing applications, but the basic facts uncovered can be used in analyzing results with other gear types, even when cut under somewhat different conditions. Differences in gear diameter, helix angle, pressure angle, hob diameter, thread angle, and setting angles of the hob would give different results but these results can be anticipated with reasonable accuracy once we have the needed insight into what makes a single-thread hob and what makes a multiple-thread do what.

Cutting Action of Single-Thread Hobs

In order to equalize chip output rate, it was decided to compare a single-thread hob running at 175 rpm with a 0.180-in. feed, with a four-thread hob at 0.045-in. feed and running at 139 rpm. using climb-hobbing in both cases.

Fig. 1 shows the point in the cutting cycle at which we stop the hob action, so to speak, to make our analytical study. This gear as shown had been climb-hobbed with a single-thread hob. The hob has 14 flutes.

Fig. 2 shows the position of the hob in relation to the gear at the point at which chip formation is analyzed. Note that the flutes are numbered counterclockwise, since we are climb-hobbing.

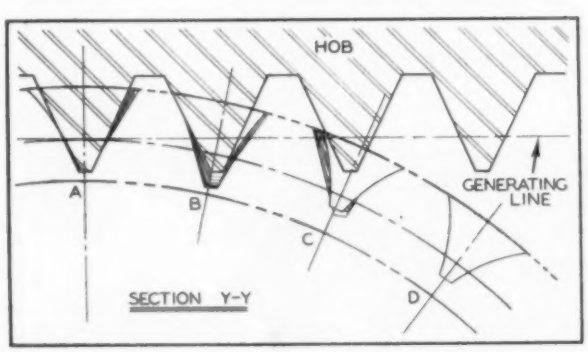
Layouts Precede Removal

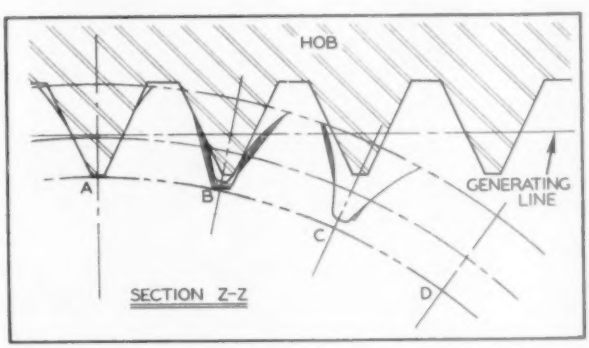
The next procedure was to make layouts of chip formation for one complete revolution of the single-thread hob, or one circular pitch of gear rotation. This revolution begins at the point where the centerline of the gear space and the centerline of the hob tooth coincide.

This single rotation of 360 deg of the hob theoretically could form both profiles of the gear space. Actually however, it does not do this. Rather, the hob is generating portions of profiles in four adjacent tooth spaces. These generated portions, if consolidated, would however represent one complete space.

In the following layouts, for simplicity and clarity, chip formation has been depicted for every *other* flute of the hob starting with flute No. 2 rather than for each flute. While this gives only half the total number or volume of chips, the shape of the chips are not materially affected except that the chips in the layouts are about twice the size of

Fig. 6. Stock removal by the various flutes produce space at section where hob teeth had not previously penetrated to root of the tooth. Fig. 7. Shows progress of work. Note most of the work has been completed previously by the hob.





those which would be obtained when actually cutting.

Fig. 3 is the important key to the chip layouts. Here S represents the hob centerline at the start of the feed; R is the centerline after one revolution. The distance between R and S—the feed for one revolution—is 0.180 in. in this case. By striking radii of the 3-in. diameter hob on lines R and S, we show the position of the hob at the start and completion of the 0.180-in. feed.

We now proceed to study the chip removal at the various sections shown in Fig. 3, first at WW, then at XX, then YY and finally at ZZ. The outline of the space at WW, after complete generation, is shown at A in Fig. 4. Note that the cut does not extend to the pitch line of the gear in this case (see section WW, Fig. 3).

Steps of Generating Action

To study the progressive generating action which has produced this space, begin at centerline C. Here is shown the material removed by the various pairs of flutes while this space rotates to centerline B which requires one rotation of the hob. The darkened portion represents the work done by flutes 2 and 4.

At centerline B is shown the material removed as the space we are following moves to centerline A. Again, we have filled in the outlines of the work done by every other hob tooth, by showing the position of the tooth as it contacts the gear. The first darkened area outside the cross-sectioned hob again shows the work done by flutes 2 and 4. The next space is for flutes 6 and 8 and so on.

Work Slacks as Space Rotates

Very little chip removal is done on the gear as the space we are following rotates to the left of centerline A. That which is done is shown by the shaded area to the right side of the space at A.

Considering now section XX (Fig. 5), by the same method of following a space from centerline C through to centerline A, we can see the progression of cuts that form a generated space for this section. Note how the depth of cut has increased. For this layout, the hob teeth start to engage below the outside diameter of the gear as the space is rotated between centerline D and C, but no stock is removed until the space passes from centerline C to B. For this section, stock already has been removed to the extent shown by the space outlined at centerline D. This stock was removed by hobbing prior to the time action was stopped to study the progression of cuts, as seen in Fig. 1.

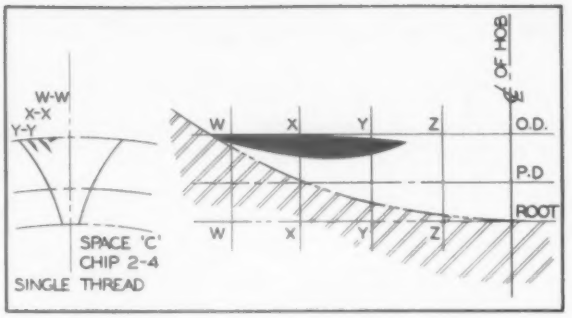


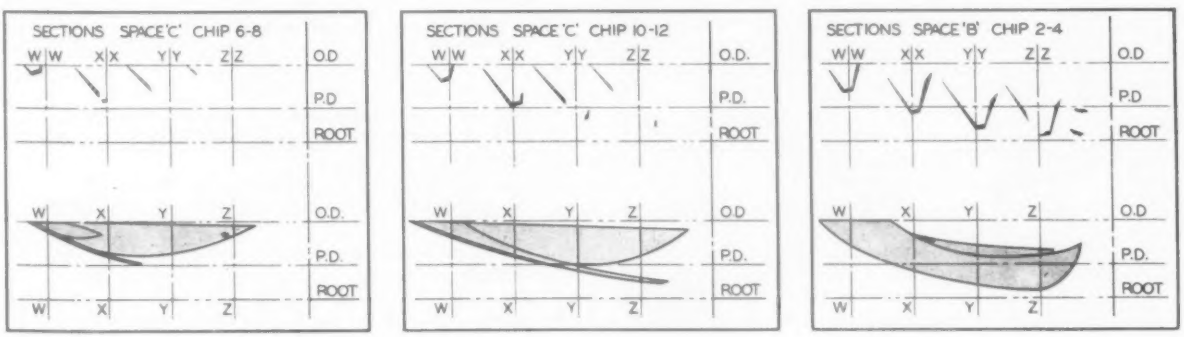
Fig. 8 illustrates theoretical chip formed during operations. Right-hand layout shows chip lengthwise, while the cross-sections of the chip is pictured at the left.

The portion of stock removed by the various flutes in spaces C, B, and A, while rotating one circular pitch to the left, are shown just as in the case of Fig. 4. The completed space as represented by section XX is shown at A. Again, very little stock is removed from the space after it passes centerline A.

Fig. 6 shows the stock removal by the various flutes in producing the space at section YY, at which section the hob teeth had not fully penetrated to the root of the tooth, as was illustrated by Fig. 3.

This shows the work done by the hob in removing the stock between sections YY and ZZ (see Fig. 7). Most of the work had already been previously completed by the hob. Again, note that very

Fig. 9 (left). Chip formed by flutes 6 and 8 during same rotation of the gear space. Cross section of chip pictured above plan view. Fig. 10 (center) shows heavier and larger third chip removed from gear space shown on centerline C. Fig. 11 (right). As space rotates from one pitch to the right to a position of coincidence with the centerline of the hob tooth, right side of the hob tooth begins to do more work, and chip is seen to be larger.



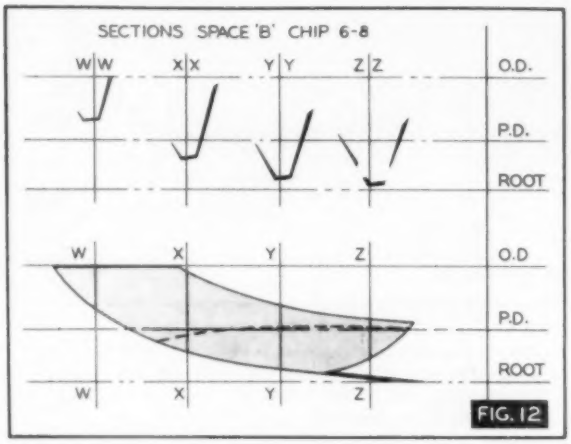


FIG. 12

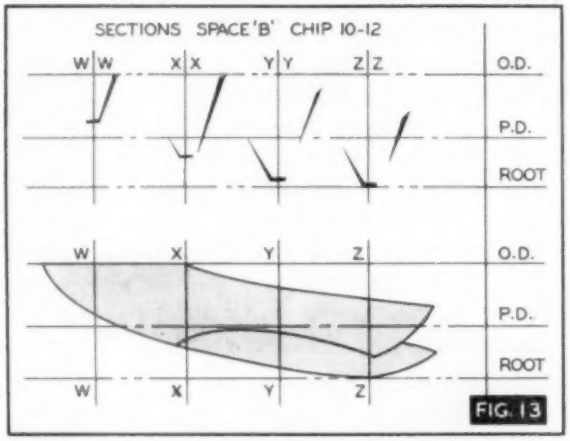


FIG. 13

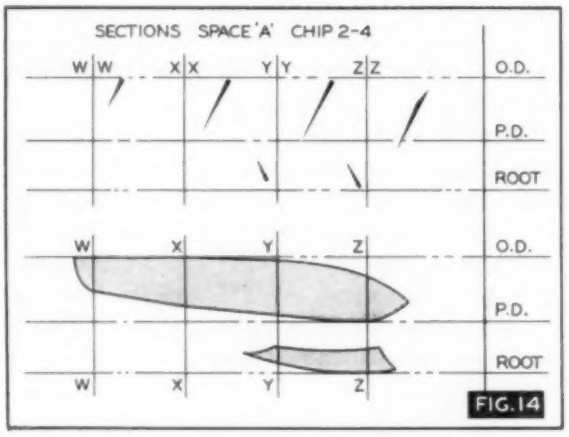


FIG. 14

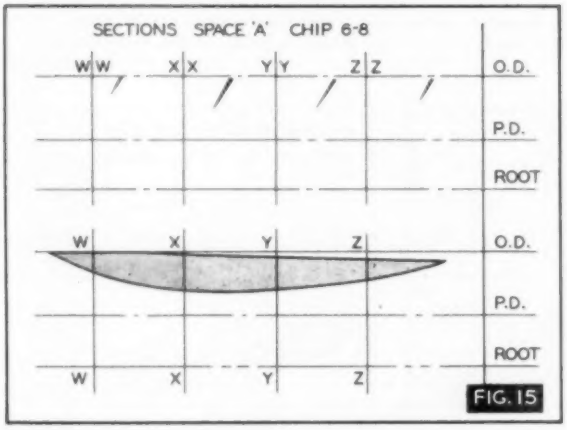


FIG. 15

little stock removal occurs after the gear rolls past a position of coincidence with the centerline of the hob tooth.

A study of these four layouts shows that:

1. Very little work is done to the generation of gear teeth after the gear rolls past a position of coincidence of the centerline of gear space and centerline of hob tooth.
2. Most of the work in the example shown is done by the hob teeth between the first and second linear pitch to the right of the centerline of coincidence between hob and gear. This applies only to the particular gear diameter used. If the gear were of larger diameter, more of the work would be done by teeth located farther to the right of the centerline of coincidence.
3. While most of the work is done by hob teeth located between the first and second linear pitch to the right of the centerline of coincidence, these particular teeth are loaded heavily near the tip of the tooth at the left side.
4. The study clearly shows why more flutes in the hob, distribute the chip load better and produce a smoother involute profile.

Conditions After Deductions

At this point, it is re-emphasized that these deductions apply only to this specific example and would have to be modified if conditions affecting the hob action were changed. The variations, however, can be predetermined to some extent for practically any set of conditions.

We now proceed to the actual study of the area and cross-section of the chips produced by each pair of flutes—2 and 4, then 6 and 8, and then 10 and 12.

Fig. 8 illustrates the theoretical chip formed by the combined flutes 2 and 4 while a gear space rotates from a position *two* pitches to the right of centerline (*C* in previous figures) to *one* space to the right of the centerline of coincidence. The chip is shown lengthwise in the right-hand layout. At the left are shown the cross-sections of the chip corresponding to positions *WW*, *XX* and *YY*.

The cross-section at *WW* represents the first work done on the gear space. The cross-sections of the chips correspond to the shapes of stock removal for

Fig. 12. Generating action has started on left side of space, and hob has penetrated to space root.

Fig. 13 shows chip formation for flutes 10 and 12 combined. Generating action on left more apparent.

Fig. 14. Work done by flutes 2 and 4 is now sharply reduced.

Fig. 15. Flutes 6 and 8 now do very little work.

the individual flutes shown in the previous figures (at space *C* in Figs. 4, 5 and 6). Here again, note that the top left side of the hob tooth does most of the work in removing metal from the gear.

In Fig. 9 is seen the chip formed by flutes 6 and 8 during the same rotation of the gear space. The plan view is shown below, and the chip cross-section above. Again, note that the heaviest cut is taken by the top left side of the hob teeth.

Fig. 10 shows the third chip extracted from the gear space shown on centerline *C*. This chip is much larger and heavier than the preceding two and is caused by the passage of hob teeth on flutes 10 and 12. The depth of cut has penetrated below the pitch line of the gear and for, the first time, the right side of the hob tooth has begun to remove an appreciable amount of stock.

Action Rotates With Pitch

Up to now we have been considering the work done while the gear space rotates from two pitches to one pitch to the right of the centerline of coincidence. We now take a look (Fig. 11) at what happens while the space rotates from one pitch to the right to a position of coincidence with the centerline of the hob tooth. The chip cross-sections correspond to the metal removal shown at space *B* in the preceding illustrations. The chip is seen to be larger, and more work is being done by the right side of the hob tooth. However, the bulk of the load is still on the left of the tooth. This view represents the combined work of flutes 2 and 4.

The chip formation by flutes 6 and 8 is shown in Fig. 12. Note that the generating action has started on the left side of the space and that the hob has penetrated to the root of the tooth space. Fig. 13 shows the chip formation for flutes 10 and 12 combined. The generating action on the left is now more pronounced.

We now take the space that starts with its centerline coinciding with that of the hob tooth and, in Fig. 14, study the chip shape formed by the flutes while this space rotates one pitch to the left. The amount of work being done by flutes 2 and 4 has dropped off sharply. Fig. 15 shows that flutes 6 and 8 do even less work. Flutes 10 and 12 do still less work (Fig. 16), since the tooth space has been virtually completed.

Chips Vary

A study of these layouts reveals, for the single-thread hob, that the chips formed by the hob teeth on the various flutes vary in thickness from 0.0011 to 0.0028 in. The chips also vary in length from 0.500 to 0.645 in. These are averages.

Next, it has been demonstrated that most of the chip formation occurs before the gear space reaches the centerline of coincidence with the hob tooth.

It has also been demonstrated that the involute is formed by a series of flats and that the larger the number of gashes, i.e., the greater the number of flats, the closer the involute profile would be to a smooth curve.

Type of Hobbing Shifts Burr

Before proceeding to the comparative analysis on a multiple-thread hob, there are a couple of points that might well be illustrated. Fig. 17 shows a gear hobbed with a single-thread hob using 0.060-in. feed. It is evident that it has been climb-hobbed, since the burr at the edge of the gear is at the *beginning* of the cut. This is always true for climb-hobbing. Note the surface finish and general smoothness of this gear as compared with the same gear

Fig. 16. Since the tooth space is now practically completed, the work of flutes 10 and 12 is negligible.

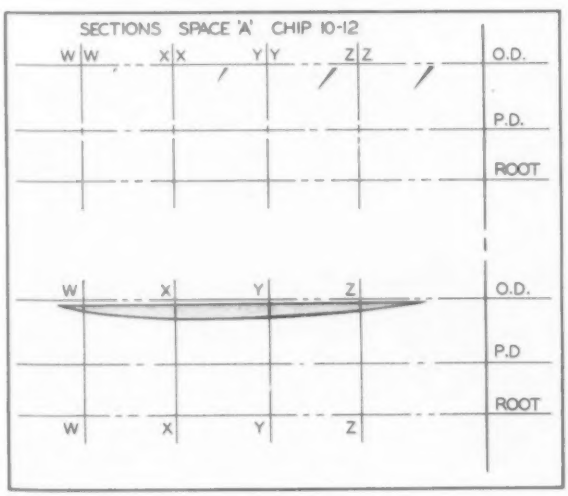
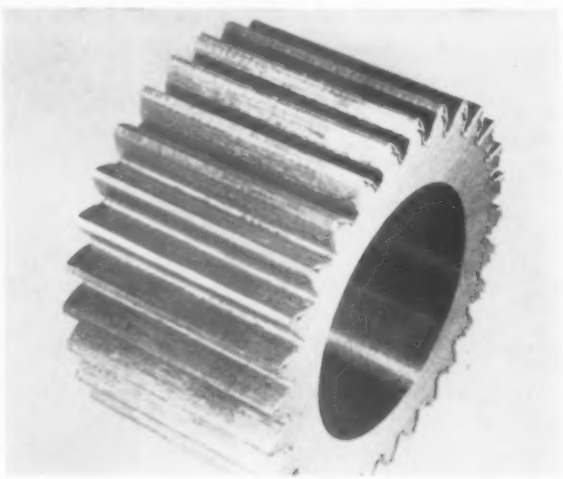


Fig. 17. Gear climb-hobbed with single-thread hob shows characteristic burr at beginning of cut.



cut with a four-thread hob (Fig. 18), using only 0.045-in. feed, in which the flats forming the involute and feed pattern occurring at regular intervals along the tooth can be clearly seen. Remember the feed here is only 75 percent of that used for the single-thread hob in Fig. 17. Climb cutting is used as indicated by the burr at the beginning of the cut.

Fig. 19 shows what happens when the gear is cut with the same four-thread hob, with the same feed of 0.045 in., but using conventional hobbing. The gear has been turned end for end to show the burr on the opposite face. Here the burrs are formed as the hob breaks through the cut. This is frequently accompanied by chips breaking out at the end of the cut with considerable velocity. As compared with the climb-cut gear, the feed pattern and flats are more distinct along the profile, with greater roughness and decreased accuracy.

Why Smoother Profiles

The reason why climb hobbing produces a smoother profile lies in the nature of the chip produced. With conventional hobbing the cut starts at the root of the tooth and sweeps upward through the OD of the gear. The chip is thus quite thin at the start of the cut and becomes quite thick as it reaches the OD. The heavier the feed the thicker the chip becomes. This heavy chip sometimes adheres to the hob tooth and is carried around by the hob so that it wedges between hob and gear causing the hob to gouge out of place on the opposite side of the space. The gouge marks can be clearly seen on the gear faces shown in Fig. 19.

This condition is not as prevalent in climb-hobbing since the hob takes a heavy cut at the OD of the gear and the chip washes away to a thin section by the time the hob tooth reaches the end of its cut.

Fig. 20 emphasizes the difference in appearance when the same gear is cut with a single-thread hob in the *same length of time* as for the 4-thread hob. Feed is 0.180 in. The rougher feed pattern and poorer accuracy of the gear is quite noticeable.

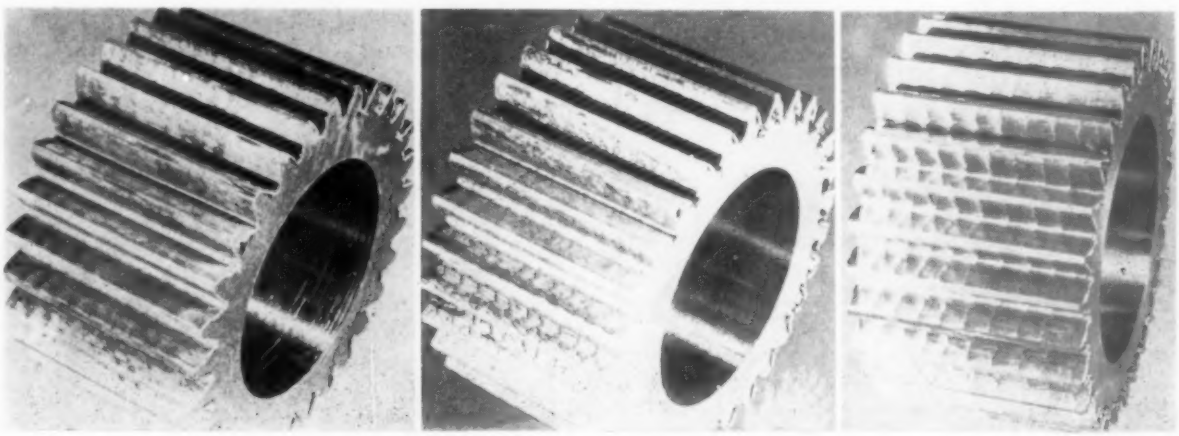
However, it should be pointed out that a 4-thread hob actually does *not* give four times the output of a single-thread hob when smoothness and accuracy are reasonably equal. While a multiple-thread hob does index a gear faster, theoretically, the fact that chip loads are heavier and that accuracy must be reasonably equal makes it necessary to increase the number of flutes and decrease the feed slightly. Increasing the flutes means a larger hob diameter and reduced rpm to maintain an equal surface speed. This, together with the reduced feed, leaves, for a double-thread hob, a net gain of 65 percent in production instead of 100 percent as compared with a single-thread hob. The production gain per added thread becomes progressively less as we go to a three, four or five-threaded hob.

Harming Possibilities of Speed

Another point worth considering here is that the speed of indexing of the work resulting from the use of multiple-thread hobs may be so high that the machine will not stand up. This is particularly true when hobbing splines or gears with a small number of teeth. To alleviate this condition, several gear manufacturers have equipped all their hobbing machines with double-thread index worms and wheels.

One more factor should be pointed out, regarding use of multiple-thread hobs. The number of flutes in the hob should *not* be divisible by the number of threads. If this design is adhered to, there will be a self-indexing condition of the hob teeth as they engage the gear, resulting in improved accuracy and finish. Similarly, a multiple-thread hob should not be used to cut gears whose teeth are divisible by the number of threads in the hob.

Fig. 18, at left, gear is climb-cut with four-thread hob, using 0.045 in. feed. Center, Fig. 19 shows gear conventionally hobbed, using same feed and same four-thread as used on gear at left. Note here, burrs are formed as hob breaks through cut. Fig. 20, right, brings out the difference in appearance when identical gear is cut with single-thread hob in same time as for the four-thread hob.



Production Evaluation of Cutting Tool Materials

By Thomas Badger

HEADQUARTERS MANUFACTURING ENGINEERING LABORATORY
WESTINGHOUSE ELECTRIC CORPORATION

SELECTING A CUTTING TOOL MATERIAL for any given application requires that a material be selected and a method for its use determined that will minimize all cost factors. These factors will involve both economic and technical considerations. A tool material selection will affect many economic factors such as direct labor, direct material, indirect expense, supervision rates, machine tool investment, factory space costs, and inventory value. The technical factors will fall within two general groupings: (1) the consideration of the properties that determine the selection of a tool material, and (2) the selection of speed, feed, and other cutting conditions necessary to use the selected material in such a way that maximum efficiency is obtained. Here, prime consideration will be given to the technical factors involved in selecting a tool material in detail; other technical factors will be considered only to the extent necessary to show the considerations involved in selecting a tool material. Other than to recognize the fact that a final selection of a tool material may be determined by economic considerations, no discussion of economic factors will be made.

The term "tool steel" is a quality term, rather than a term that specifies any specific composition, properties, or even performance. The term is defined only by the traditions of the trade, rather than by any specific technical terms. However, custom has almost standardized the care that must be observed in the selection of ingredients; in the analysis, melting, pouring, billet preparation, and in heat treating rolling practice, and even the method of packing for shipment. Some tool materials, such as cast alloys and carbides, are not steels but, here again, the term denotes that the manufacturing process is carried on with the greatest care.

All tool materials commonly used today for metal cuttings are made from four basic classes of tool materials: (1) Carbon tool steel; (2) High-speed tool steel; (3) Cast alloys; (4) Carbides.

Unfortunately, none of these tool materials is superior in all respects to the others. In order to make a selection, the principal factors necessary to select a cutting tool material must be defined.

Red Hardness is the term used to define a material's resistance to the heat generated (usually heat sufficient to produce a dull red glow on the tool) during the cutting process. More specifically, it is a tool material's resistance to softening at elevated temperatures. This quality of red hardness is perhaps the most important quality of a cutting tool material.

Hardenability is the term used to define a tool material's response to heat treatment as this response is affected by its mass. Note that this term does not denote hardness. If a steel bar of say 3 in. diameter were quenched from the hardening temperature and the material was found to be hard to a depth of $\frac{1}{8}$ in., it would be considered a shallow hardening material and so would be said to have a low hardenability. If the bar were of a material that under the same conditions would harden through the entire 3 in. cross section, it would be considered a deep hardening material and so said to have a high hardenability.

Hardness is considered to be the property of a material that resists indentation. This may not be a perfect measure of hardness, but it is the one that must be depended upon to obtain an engineering measure of this property because all hardness testing machines in common use are based on measuring exactly the penetration of a standard indentor under a fixed load. The property desired in cutting tools is a high value of the ratio.

$$\frac{\text{Hardness of Tool}}{\text{Hardness of Material Cut}}$$

When a material approaches the hardness of the available cutting tool, it becomes unmachinable.

Response to Heat Treatment is important for reasons that will be shown in some detail later.

Presented at Annual Meeting, American Society of Tool Engineers, March 15, 1951.

But tool materials are rather loosely classified in the following types: (a) Water hardening; (b) Oil or air hardening; (c) Hardenable only by chill from casting; (d) Materials having no response to heat treatment.

In general, both for tools as well as for machine parts, a water hardening material is the least desirable type. First, because the material in the hardened state is extremely brittle and so subject to breakage. In practice, however, this is easily overcome by tempering. Second, the quenched structure of a hardenable steel has a larger volume than the structure existing at the hardening temperature. Since the hardened structure forms first on the surface in contact with the cooling medium, and the internal area transforming later expands within the rigid case, causing terrific internal pressures, it is not uncommon for drastically quenched tools (such as with water) to burst from this effect. And, third, a water quench, being such a drastic quench, produces stresses because of the temperature differential that may remain in the tool. For these reasons many tools are lost in the heat treating process.

Oil and Cool Air Also Used

Other materials will develop the required hardness when quenched in oil, and since oil has a cooling effect from one-half to one-third that of water, the stresses mentioned above are considerably reduced. Other materials will harden in a cool air stream—some will actually harden in still air—and this easy quench drastically reduces the structure and temperature stresses. Aid hardening is certainly a desirable property of a tool material.

Most hardenable materials will harden if poured into a cold mold, but as far as tool materials are concerned, this effect, known as a "chill", is used only with case alloys. The disadvantage of this method is that the tool must be cast to its final shape since it is impossible to subsequently soften, fabricate in the softened state, and restore the desired hardness by heat treatment.

The sintered carbides show no response to any known heat treatment, since the hardness is a fixed property of the carbides used in making the tool material.

Strength. In discussing tool materials, it is not usual to express strength in pounds per square inch or other measures. Such measures are taken, of course, but only as a research project. In tool materials strength is a relative quality.

Toughness is another quality that is relative in tool materials. A standard test has been devised that measures the force in inch-ounces required to break a knife edge section, but this test has never gained wide usage.

The ease of fabrication of any tool material is certainly important. The qualities usually considered are: (a) Forgeability; (b) Machinability; (c) Ease of grinding; (d) Ease of brazing or welding; (e) Edge keenness possible, and (f) Ease of heat treatment. These factors will be later discussed for each type of tool material.

Design Limitations

All tool materials have certain properties that cause design limitations. A few of these will be considered for each type of tool material.

Cost. It is desirable and important to compare costs of one tool material with another when considering the other factors. Generally, the cost of a good tool is usually insignificant in comparison to the cost of the work it performs. However, there are times when the cost and upkeep of a certain type of tool prohibits the use on certain operations. Several things must be considered in addition to the cost per pound of the tool material. Is there enough activity to justify making the tool? Will the use of the tool necessitate buying additional expensive equipment, such as holders, grinding equipment, etc.? Are the properties of the material and tool such that the upkeep or maintenance will be too great? Is the metal removal rate justifiably increased? Are there definite limitations relative to its use, i.e., must it be used only by skilled workmen, etc.? Other similar questions can be raised when considering new tools. The total cost per cubic inch of metal removed is most important, and all factors should be carefully considered in order to keep this cost as low as possible. Tools are the key to efficient productivity and they should receive as much, if not more, attention than the manufacture of the product itself.

Carbon Tool Steel

Carbon tool steel is a tool steel whose principal alloying element is carbon, usually in the range from 0.75 to 1.20 percent. Silicon, manganese and vanadium are always present, but usually in amounts less than 0.50 percent. As the carbon content of a *C* steel increases, the hardness increases, but at a sacrifice of toughness. As a general tool material, *C* tool steel accounts for the largest tonnage of tool steels used, but as a cutting tool it is obsolete and seldom used today except in special applications. Considerable detail about *C* tool steel is given here because such a discussion presents the general fundamentals of all tool materials and provides a basis for comparison and selection of all tool materials. Considering *C* tool steel by the factors essential in a tool material:

Red Hardness: Carbon tool steel has a very low red hardness as it softens at about 600-700 deg F. This disqualifies it as a cutting material for

present day use when such high speeds and feeds are necessary.

Hardenability: Carbon tool steel has a very low hardenability and is very shallow hardening. Since the depth of hardening in ordinary sections would be from 1/16 to ⅛ in., the hardened section would be removed in two or three regrinds and the tool would be useless. A few tools of small section size, such as twist drills up to ½ in. diameter, are still used. In fact, carbon twist drills are preferred in drilling abrasive materials of low tensile strength, since the high hardness of the carbon drill resists abrasion and a low tensile strength material usually does not produce sufficient heat when cut to draw the temper from the carbon steel.

Hardness: Carbon tool steel can be quenched to a higher hardness than any other tool material except carbide. A reading of Rockwell C 68 can be reached with *C* or carbon content of 1.00 percent or more. This hardness is attained with such a poor balance of other properties that *C* tool steel finds no application without tempering to a lower hardness.

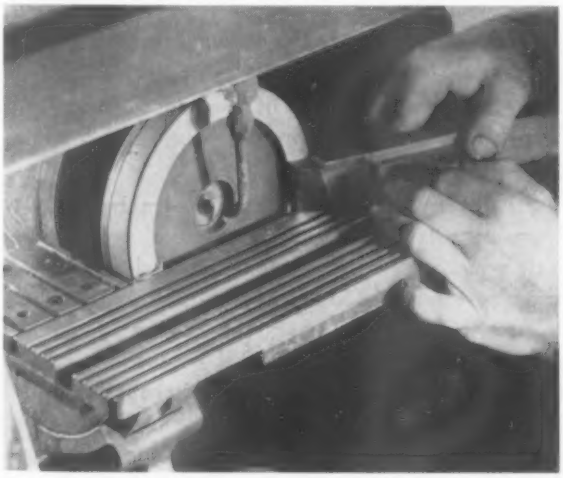
Response to Heat Treatment: A carbon tool steel is either water or oil hardened. This results in high stresses, and distortion. Unless the tool is very simple in design, breakage in the quench is common.

Strength: Carbon tool steel is so brittle that its high strength is of no use. But proper tempering produces an extremely strong material, with a consequent sacrifice in hardness.

Toughness: Carbon tool steel has no toughness in the full hard condition, but properly tempered *C* steel is the toughest tool material known. This property again is reached only with the sacrifice in hardness.

Ease of Fabrication: Carbon tool steel is easily forged and freely machineable in the annealed state.

Through proper and careful sharpening of the cutting tool, better work is produced and considerably longer life for the tool is gained.



It is easily ground in the annealed, quenched or hardened and tempered states. In the full hard condition as quenched, it is susceptible to grinding failure. Carbon tool steel can be ground to a sharper edge than any other material. This accounts for its almost universal use in such tools as hand metal scrapers. Carbon tool steel is not ordinarily welded as special techniques are required.

Design Restrictions: For best hardness, the section size of *C* tool steel must be small; considerably under one inch is best. It is almost impossible to quench a part that has a small section joining a larger section because the high temperature differentials between sections causes cracking. It is possible to heat treat such sections if it is possible to design with large fillets, or to drill holes or otherwise relieve the large sections of the part. In general, any intricate shape is hard to handle in the heat treat.

Cost: Carbon steel is the cheapest cutting tool material.

Summary: Carbon tool steel is obsolete today for a machine cutting tool material because of its low red hardness. However, it is widely used for hand tools, and for tools where an extremely keen edge is desired.

High-Speed Steels

High-speed steels are available in a variety of types but, regardless of type, a striking similarity is evident in their physical make-up. They all possess a high alloy content; they usually contain sufficient carbon to permit hardening to file hardness; they harden so deeply that almost any section encountered commercially should have a uniform hardness from surface to center; they all harden from high temperature, and their rate of transformation is so slow that they can be cooled in still air and still reach near maximum hardness.

There are three general classes of high-speed steels in common use:

The 18-4-1 type, so called because it contains 18 percent tungsten, 4 percent chromium, and 1 percent vanadium. This is one of the oldest, but still the most commonly used, types of high-speed steel. It is the best general purpose grade, and the one normally used where no special properties are required.

Moly type is the description of a family of high-speed steels that attain their red hardness by the substitution of about 5 percent molybdenum for about 12 percent of the normal tungsten content. Many analysis are available, but the so-called 6-6-2 is typical, containing 6 percent tungsten, 6 percent molybdenum, and 2 percent vanadium. This type, if properly heat-treated, is comparable in efficiency to 18-4-1 and considerably cheaper. In such tools as drills and taps where toughness is

required, moly high-speed steel is actually superior to other types. This type gained popularity during the war when tungsten was scarce, and it is also used not only because its cost per pound is less, but because its specific gravity is lower, further reducing the cost of a tool.

Super H.S.S. for Heavy Work

The so-called **super-high-speed steels** are usually a richer alloy base; a common analysis is 20 percent tungsten, 4 percent chromium, and 2 percent vanadium, with the addition of 5 percent to 12 percent cobalt. This type is useful in heavy roughing operations where severe heat and pressures are developed in the tool. This is not a general-purpose grade of high-speed steel, and the fact that the cobalt content causes the price to range from 50 to 100 percent over the standard 18-4-1 analysis is somewhat of a disadvantage.

Considering high speed steel by the factors essential in a tool material:

Red Hardness of all high-speed steels is excellent. All high-speed steels can be used at speeds and feeds that will cause the tool to operate at a dull red heat. The maximum temperature possible without failure is about 1300 deg F. The red hardness is higher than for any other steel. This high red hardness permits high-speed steel to be used at cutting speeds from two to four times that possible with *C* tool steel.

Hardenability of high-speed steel is excellent, in fact it can be considered perfect since any commercial section can be completely air hardened to the center of the section. The largest billets are normally 8 in. square, but even larger forgings made from these billets can be hardened to the center with an air quench.

Hardness: A high-speed steel will harden to Rockwell C 65, a value very close to that possible with *C* tool steels. In practice, the hardness of an air-quenched high-speed steel tool is about Rockwell C 63, but tempering causes the hardness to increase to Rockwell C 63.5 to 64. This increase in hardness is a peculiar reaction possible only with high-speed steels and is produced by the so-called "double draw". It is universal Westinghouse practice to use the "double draw", with two periods of two hours at 1050 deg F in the tempering cycle. This increase in hardness in tempering can be simply explained by the fact that at the extremely slow transformation times possible with high-speed steel, the reaction tends to become stable with about 20 percent of the austenite remaining. The first tempering cycle of two hours at 1050 deg F not only causes the familiar tempering of the martensite, but tends to make the remaining stable austenite unstable. The cool from the first tempering heat then causes the remaining unstable austenite to transform to virtual completion. The second tempering cycle then completely tempers both the primary and secondary martensite. The presence of the larger amount of martensite in the tempered product, compared to the quenched product, accounts for the increase in hardness, rather than the decrease normally expected, in the tempered condition.

Response to Heat Treatment: The extremely mild air quench possible with high-speed steel enables this steel to be hardened with a minimum of distortion, size change, or temperature stress. No difficulty due to breakage is experienced with heat treating even the most complicated high-speed steel tools. The low stresses present in a quenched and tempered high-speed steel tool are so low that final grinding can be done with a minimum of difficulty.

Strength: The high strength of high-speed steel enables tools to be made in small sections or intricate contours with but little breakage under careful use.

Toughness: High-speed steel is very tough; in fact, no other tool material has such a good blend of toughness and strength at the hardness range of cutting tools.

Ease of Fabrication: High-speed steel is easily forged, although careful workmanship is necessary. It is freely machinable in the annealed state. It can be freely ground in any condition. With the proper technique it can be welded or brazed to other steels. It can be ground to an excellent cutting edge, second only to *C* tool steel tools.

Design Restrictions: There are practically no limitations on the design of high-speed steel tools, a fact that makes high-speed steel very useful in some applications that would not otherwise require its properties. There is no limitation on size, except the maximum mill sizes available, this being about 8 in. square by 6 x 8 ft. in length. High-speed steel will stand a maximum of poor design. The only common source of difficulty is cracking from notches, re-entrant angles, stencil markings, or keyways that act as stress raisers in service.

Cost: Standard types of high-speed steel cost from two to six times more per pound than carbon steel, depending on the type.

Summary: High-speed steel has a balance of desirable properties that has made it by far the most widely used cutting tool material in use today. No other tool material combines so many of its properties. However, in the cutting tool field, high-speed steel is losing ground because the newer cast alloy and carbide materials have a superior red hardness, and most tools do not require the balance of properties present in high-speed steel.

Brittle Coatings for Stress Analysis

By Greer Ellis

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EXPERIMENTAL STRESS ANALYSIS is concerned with how to make structures that will not only be dependable but also have desirable characteristics such as lightweight, lower cost, and ease of fabrication. Most of the problems where experimental stress analysis is really worth its salt involve fatigue loading—that is, many thousands of cycles of repeated loading during the service life of the part. Under repeated loadings, failure is most likely to start as a small fatigue crack in some localized area of high stress and then grow slowly until finally a full rupture occurs.

Because time is an essential factor in building up the cycles of load, the first intimation of serious trouble often comes only after many parts are already out in service and full-scale production is under way. In the resulting emergency experimental stress analysis can be important because its processes can shortcut the time factor and point the way out of trouble faster than traditional "make 'em and break 'em" methods.

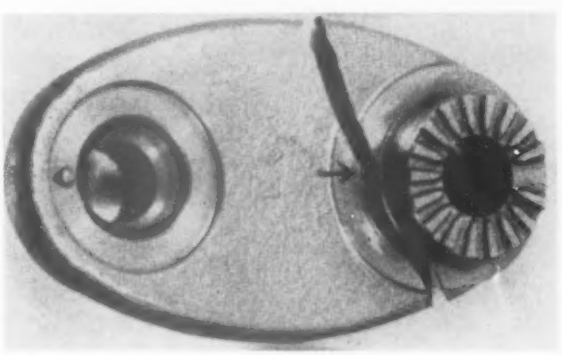
Even though tool engineers may not directly handle the tools of experimental stress analysis, they are strong aids to production that are well worth knowing.

Tools of Experimental Stress Analysis

There are a number of experimental stress analysis instruments and techniques that might be used in solving individual stress analysis problems. The three most practical are: brittle coatings, bonded wire strain gages and related equipment for dynamic and static measurements, and fatigue testing machines which can handle full sized parts. Most problems are solved by using a combination of these tools.

The brittle coatings can be applied to any surface. Like glass, they crack wherever the tension stress gets above a certain amount. The cracks run exactly at right angles to the heaviest tension stress. There is a direct correlation between the patterns coming in the brittle coating and the likelihood of fatigue failure in a metal part because there is the interesting analogy that brittle materials like glass will fail in a single application of load in the same manner that a ductile material like steel will fail after millions of cycles of load. Under a single static loading, brittle coat patterns will show where fatigue failure may occur under a great many cycles of load on the actual part. The brittle coatings can also be used under dynamic loading conditions, but it often simplifies the test program to be able to get results in a single application of load. Advantages of the brittle coating method are that it provides an overall survey of stress distribution; it shows exactly where and in what direction to place strain gages; also, brittle coatings can make quantitative measurements of highly localized stresses which occupy too small an area to be readily measured by strain gages. Disadvantages are that the coating can be used only once and the coatings are sensitive to temperature and humidity

Fig. 1. Fatigue failure occurred in this crankshaft during test running. Markings point to the origin of failure in the fillet exactly under the center of the crank pin.



Presented at Annual Meeting, American Society of Tool Engineers, March 15, 1951.

conditions.

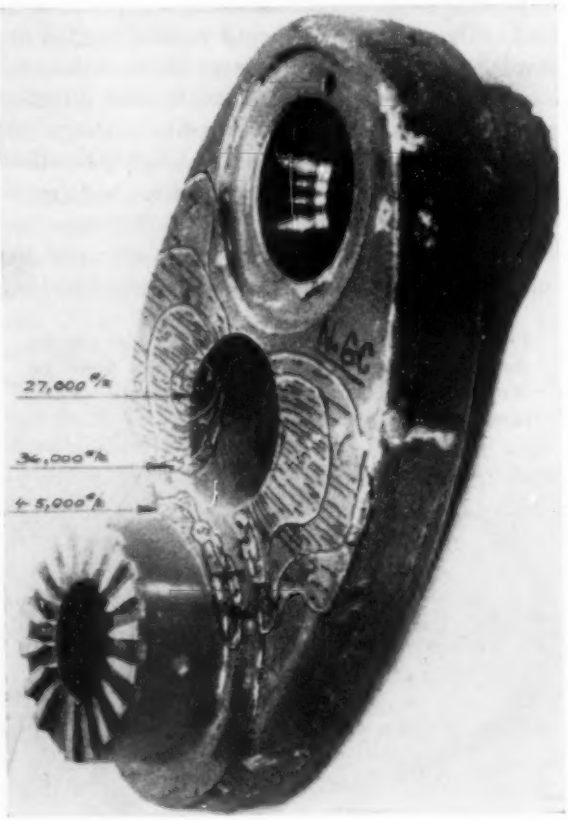
The bonded wire strain gages are about the size of a postage stamp and are pasted on anywhere in order to make exact static and dynamic measurements. Their big advantages are that many measurements can be made under both static and dynamic conditions and with excellent accuracy. Their disadvantages are that they measure stress at one point and one direction only for each gage element, and that leads have to be brought out to the associated measuring instruments.

Fatigue machines which put many cycles of load on the actual parts can not only compare overall results on finished parts but they can make detailed comparisons of different materials and methods of fabrication. Disadvantages are that results take time to obtain; specimens are often expensive; and the results are a composite of so many variables that at times there is danger of losing sight of the individual effect of each variable.

Method of Attack

Experimental stress analysis methods are essentially "cut and try." These tools are used to answer specific questions. Six engineers will usually have six solutions to a problem. One thinks the loads have some excessively sharp peaks. Another thinks the failure came from a bad stress concentration point; another thinks machining is in the wrong direction and so on. Probably one or more of the ideas is on the right track. But who knows? Experimental stress analysis will settle the arguments.

Fig. 2 shows points where most load was taken before failure. Section with hole in the center proved to bear about twice the load the original section took.



The service loads can be measured with bonded wire strain gages and oscillograph. Brittle coatings will measure the stress concentrations. Fabrication methods can be checked by fatigue testing.

A first batch of tests is necessary to clarify what caused the trouble. This gives a sound base for intelligent engineering of ways out of trouble. Then a second batch of tests shows how good the redesigning was and frequently provides new leads for another round of further refinement and checking. The final solution is often a combination of improvements in one or more of the three independent paths to structural strength: load, shape and material.

Case Histories

The following case histories will show how practical problems were licked. Data are derived from experience in the application of Stresscoat, a trade-named product of Magnaflux Corporation.

Crankshaft Failure in Bending: An experimental crankshaft developed several similar failures during test running. The failure is shown in Fig. 1. Oyster shell markings point to the origin of fatigue failure as in the fillet exactly under the center of the crank pin. That failure pointed to stress concentration in the fillet under bending load as the cause of trouble. Several different cures were suggested, including (a) a more generous fillet; (b) a special carefully rounded-out undercut fillet, and (c) the unorthodox idea of putting a hole in the web below the point of trouble.

Evaluation Problems

These are all good ideas, but how to evaluate which is best? Old style procedure would be to make up one or more crankshafts with each of the different ideas and run them in engines—quite an expensive and time-consuming operation. In this case the experimental stress analysis attack was tried.

Since only the "shape" factor was to be investigated, the brittle coating method alone proved to be the only stress analysis tool needed. A crankshaft section for each of the ideas was fabricated. A simple static test jig was designed for putting bending load on the section by means of a hydraulic jack. Loads were measured by pressure gage in the hydraulic jack line. It took about a half day to make up the test jig. The various sections had brittle coating sprayed on them and they dried overnight in a cabinet with an electric light bulb in it to keep the temperature up around 90 deg F. Next

day each section was tested in turn by applying increasing loads until the crack patterns were observed to start in the coating and then spread at higher loads. Naturally, the higher the amount of stress, the less load would be required to get a coating pattern started.

The first test run on the original section brought in the first crack pattern in the coating at exactly the same spot where service failure occured. Then it took a lot more load to bring in patterns elsewhere. This was encouraging confirmation that the earlier static test was on the right track. Comparative results on all the sections showed that the carefully hand-worked undercut fillet took about twice the load that the original section did before patterns started. But the most interesting result, shown in Fig. 2, was that the section with the hole in the center of the web also took twice as much load before the first pattern started in the coating, and therefore should be twice as strong as the original section.

Secondary Weaknesses Also Shown

Another finding from the test, which shows the superiority of experimental stress analysis methods over the "make 'em and break 'em" method, was that it is possible to go to higher loads and find out where the next weaker sections are—something that doesn't show up when parts are broken. It was immediately found out that the hole in the web, about which some doubt had been expressed, required a lot more load before brittle coat patterns could be started at the edge of the hole. Therefore the hole was safe.

To round out the analysis, several more sections with holes of different sizes were tested to decide the optimum. The whole test program took about a week. New crankshafts were made up with holes in the webs and no more of this kind of trouble was experienced.

Connecting Rod Caps: Another test involving the brittle coating method alone dealt with connecting rod caps for a medium-sized engine in high production. A change had been made in suppliers. The new caps had minor variations in the configuration of webs on the bottom of the cap. Engineers who had confidence in the old configuration did not want to risk letting the new configuration go right out into production. It would have taken several weeks to make a new die. In the meantime production would have been shut down, and additional expense incurred for the die.

Again only the "shape" factor was involved so brittle coating alone did the job. A static tension test was made in the matter of a couple days' time comparing the new and old connecting rod caps. Results showed that the new configuration had no influence on the maximum stress values. So the new caps were accepted immediately into production and no reason has developed to regret the decision.

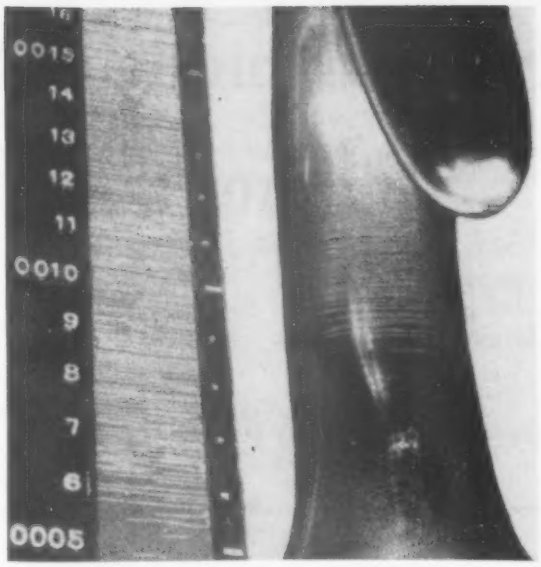


Fig. 3. Coated calibration strip is dried along with part under test and loaded in special testing jig which applies known strains.

How Brittle Coatings Work

There are a whole series of brittle coating formulations to take care of different temperature and humidity conditions as well as different amounts of stress required to fracture the coating. An aluminum pigmented undercoating is sprayed on before putting on the brittle coating in order to provide a uniform bright working background. Brittle coating is sprayed on and then allowed to dry overnight at room temperature or a little above. Or it can be speeded up by drying a couple of hours at 130 deg F.

Several calibration strips are always coated and dried along with the part under test. These are loaded in a special testing jig called a calibrator which applies known strains. The strip after loading is seen in Fig. 3. The strain scale in which the strip is placed shows just how much strain is required to start fracturing the coating. Quantitative accuracy is possible only at the one strain value where patterns start to form. All that can be said about more dense patterns is that they are above the threshold strain value.

The coatings crack only under tension strain. However, compression stresses can be evaluated by imposing the load during the time that the coating sets up so that they are unaware of any strain in the part. Then when the load is released the relaxing compression strain acts as a stretching tension effect as far as the brittle coating is concerned, and the coating cracks.

Some Practical Aspects of the Time Standards Problem

By H. K. Keever

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THERE ARE THREE parties that must be considered in any installation of standards. They are management, labor and supervision. Any installation that favors management at the expense of labor, or favors labor at the expense of management, is bound to fail. In between is the supervisor that transmits information from management to labor and back again. His understanding and cooperation is equally necessary.

Management expects a standards installation to more than pay its own way. This is true whether it is used in connection with an incentive system or not. He expects such an installation to secure the maximum output from machinery and equipment. He wants to do this with a minimum expenditure for time study work, and with a minimum increase in overhead for payroll and other services.

Labor feels that the standards should call for no greater increase in production than he can perform without added fatigue. He expects to share in any savings that are derived from either methods improvements or through the use of standards as a means of control. He wants the right to complain as to the fairness of the standards.

The supervisor wants to understand, in simple shop terms, what the standards cover. He wants to be consulted on any changes in shop methods or practices called for by the standards. Without a clear understanding of these two factors, how is he going to explain to the worker what is expected of him.

It is in trying to satisfy all three parties that the experience of the industrial engineer is put to the test. Experience in the making of the *practical* decisions necessary to do the following:

1. The work covered, by the standards, must be performed according to a *uniform* shop practice day in and day out. It is preferred that this be the best shop practice but that cannot always be economically attained. Whatever shop practice is used should be the one that can be relied upon day in and day out. This means that *all tools* must function the way they are supposed to. As will be subsequently shown, this is the heart of a good standards installation.
2. The work to be performed, in the standard time, must be fully described in short but complete steps, using customary shop terminology. All metal cutting practices, such as speeds and feeds, etc., must be specified. The amount of stock and working tolerances on the various operations must be known. Otherwise, the number of cuts to be taken will not be in accordance with the number chosen in setting the standard. Locating surfaces must be stated. Measurements to be made must be shown on the operation sheet. This and many other mechanical details must be decided upon prior to the setting of the standard.
3. The standard time for one operation must be comparable with the standard time of another one. This means that the standard time for any step or *element* of work should be the same wherever it is used. Skilled workmen have the ability to compare one job with another based on elements of work. They can accurately state the difference in each operation. They expect the standard time for the job to reflect this difference. The industrial engineer must be thoroughly grounded by experience in deciding *what these elements are* and *how* they should be designated.

Therefore, a study of shop methods for uniformity in practice must precede a standards installation.

Presented at a combined meeting of The American Society of Tool Engineers and The American Society for Metals; Cleveland, Ohio.

Also standard data—time for each element of work to be performed—must be developed and employed. Management and supervision expects this to be done with a minimum of disruption to the normal routine of operating a shop or office.

Steps in Standards Installation

How this is done can best be explained by stating the procedure employed to make a standards installation. The steps in such a procedure usually are:

1. Study about 100 sample jobs. If you have standard data, this task is greatly simplified. Standard data is the term applied to a collection of time values that state how long it should take to perform any element of work either by a man, or by a piece of equipment. If you do not have standard data check time studies would have to be made.
2. Compare the standard time for *each* of these 100 jobs with past performance. Analyze this difference into the time lost due to:
   a. The tools not functioning according to good practice.
   b. The lack of understanding as to what the worker is to do. This includes the matter of servicing the worker. Is he supposed to be supplied with tools in satisfactory working conditions, or is he supposed to secure his own tools and put them in good working condition? It is surprising the amount of production that is lost because this step is overlooked, or is poorly organized.
   c. The worker because he is not working at a normal pace.
3. Compute the net savings to be secured in dollars i.e. the difference in the new standard cost from the old actual cost. In doing so be sure to allow for the money to be expended:
   a. For mechanical improvements, such as checking jigs and fixtures, alignment of machines, etc.
   b. To operate the standards department. This would include all additional route men, rate setters, and clerks for "paper work".
   c. To labor as a premium or bonus for attaining these standards. This amount is usually collective bargained with labor. Management must, therefore, know *in advance* the results to be expected from the new standards.

Standardizing Shop Practice

In order to secure uniform shop practice upon which to set standard times, the following usually require preliminary attention:

1. All metal cutting practices must be standardized. This means that the amount of stock to be removed must be known. Also surface finishes. Speed and feed tests must be made on each type of material and equipment. As a result of these studies the shop is told how many cuts are required for various types of surfaces. Also what speeds and feeds are to be used.
2. Tool cribs must then be organized. Shapes and angles of cutting tools must be standardized. The method of grinding to allow for chip breakage, etc., must be stated. Furthermore, it must finally be decided whether it is more economical to deliver the tools or to have the man come after them. In most shops the former is the least expensive.
3. All machines must be calibrated as to the rpm under which they are to be operated. Also as to the degree of precision that can be expected from various types of machines. Some machines have to be realigned. Others have to be rebuilt. In other cases it is not practical to do either of the aforementioned and the standard times must take this into account for all jobs done on such machines.
4. All jigs and fixtures have to be examined for:
   a. Ease of handling the part in and out.
   b. If clamps are used, how many are necessary for a particular job.
   c. Where universal jigs for small work would be economical.
   d. Likewise, where standard or interchangeable bushings are economical to use.

   There are two factors in the use of jigs and fixtures that affect the standard time in many instances. They are the length of approach to cut, and ease of cleaning. Particular attention must be given to these two factors if you expect to set a standard time explainable to supervisors and to workers.

Organizing the Standards Department

It is a natural step from the standardization of shop practices to the development and use of standard data. Anyone who has had experience in setting up standard data can cover all elements of work for any one of the major machine tools on one sheet of paper. (See Fig. 1). They will cover every possible step that can be taken from loading the piece through cutting and measuring it, on up to and including unloading. Standard data also covers the time for making all the attachments used in assembling parts into mechanisms, and mechanisms into machines.

The compact manner in which standard data is compiled enables the standards department to proceed to route work and set rates with a minimum of personnel. After the standard data has been

developed there is no need for further time study work.

Thus four of our major objectives are obtained. To repeat they are:

1. A reliable and accurate standard of output can be set by a minimum of personnel without interruption to the normal operating functions of the business.
2. Standard data points the way to uniform shop practice, i.e., correct speeds and feeds, good jig and fixture design practice, and to economical service from the tool cribs. All of these contribute to an efficient operation of the plant.
3. The standard time of one operation or job is comparable with another. Any difference in standard time can be explained to the worker and/or supervisor by showing the additional steps required from one job to another.
4. Through standard data we are able to set a variable fatigue allowance depending upon the ratio of handling time to machine time. Labor gives considerable attention to fatigue allowances. The use of a general percentage for fatigue is no longer acceptable. This fatigue must allow for certain rest periods and must be comparable to the mental and physical effort required by the various types of work done.

Labor's Interests

This paper gives particular attention to those factors that are of interest to labor. How important this is to the success of any standards installation may be seen from the following guarantee commonly employed. It is taken from a labor contract.

RATE CARD

MILLING MACHINE

SETUP ELEMENTS

JOB CHANGE ALLOWANCE

TABLE SETUP

EFFORT ELEMENTS

"The employer agrees not to reduce the allowed time for operations unless there is a clerical error, or unless changes are made that necessitate a revision of the allowed time in order to maintain a consistent relationship on a basis of similar or comparable operational elements. Such changes may be in methods, feeds, speeds, mechanical equipment, tools, fixtures, materials and designs. Any such changes shall not affect an operator's earnings provided that the operator maintains substantially the same efficiency and effort on changed operations, as before such changes were effected."

With such a clause in the contract, the worker feels protected against wholesale rate cutting. The clause is also of benefit to management, as it defines under what circumstances rates may be changed.

This requires that management give immediate attention to any rates that should be changed due to methods changes. This must be done promptly.

Rectify Off-Standards Quickly

Similarly, management must give immediate attention to all off-standard conditions in either materials or machines. As time goes on machines deteriorate. Also suppliers of castings and other materials become a trifle careless. Patterns become worn. An article as long as this one could be written on all the little interferences to production which occur in the best run shops. These must either be corrected or standard time allowances made for them. These allowances should not be either guessed at or collective bargained if they want to stand up under a grievance procedure. The amount of additional work due to the interferences must be defined and an allowance made from the standard data table for this additional work. Otherwise, the grievance procedure will eventually break down the entire standards installation.

The Supervisor's Interest

Throughout this program the supervisor must be thoroughly informed. All mechanical changes should be cleared through him. He should be given instruction in how standard data is developed and used. The best form of instruction is by means of classes—preferably in the evening. A half dozen or so classes covering each of the steps of the installation will suffice. This class instruction enables the supervisor and the standards engineer to talk a common language when they are on the floor and explaining a standard to a discontented worker.

A Differential Gaging Device for a Cam

By Jay N. Edmondson

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THE GAGING DEVICE to be described is built on the principle of differential gaging. It permits rapid inspection of a very small stamped face cam to a high degree of accuracy, and may be used by an unskilled operator. Many variations will occur to the gage designer to permit the same principle to be used for other products.

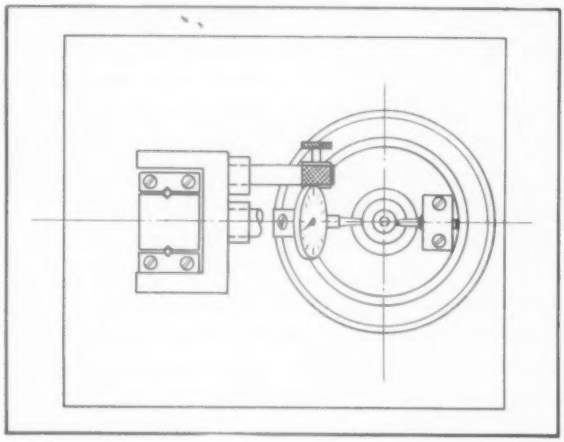
The approximate requirements of the product are shown on the drawing. Note that the bottom surface of the cam contains both flats and areas of rise, of varying degrees. Indexing with respect to the slot is important. In addition, the cam must be checked on a shoulder of the same size as that on which it is to be mounted in the assembly. Therefore the shoulder on the spindle has been made the required mounting diameter.

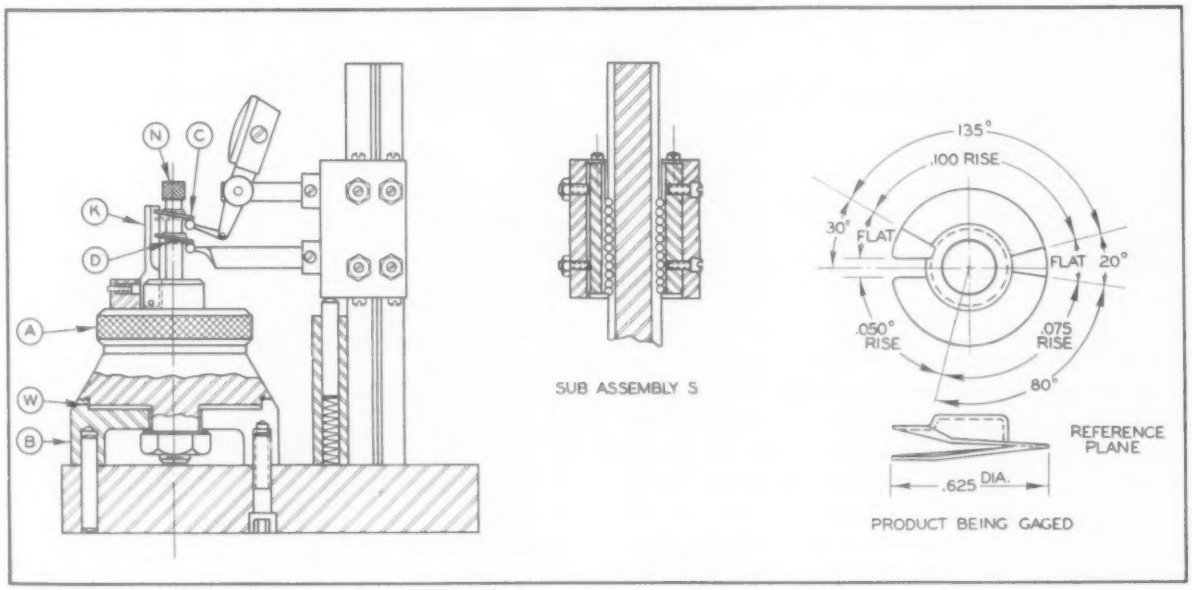
The main body of the gage consists of two parts, *A* and *B*, which are aligned on diameter *W*, thereby obtaining greater accuracy than would be possible with center-shaft alignment. Part *A* is rotated by hand.

The cam to be inspected is located at *C*. Cam *D* is a master cam, secured on the spindle. Key *K* is wedge-shaped, spring-backed, and pivoted to cause exact alignment of the slots. Only cam *C* is removable when the nut *N* is taken off.

Construction of the sliding mechanism is shown in section in the side view. The sub-assembly *S* is free to slide up and down the column on the steel balls. Spring pressure under the pin keeps the indicator and the master cam gaging fingers in contact with the under-surfaces of the two cams, at constant pressure.

Any variation of the cam under inspection will be recorded on the dial indicator. Suitable limits marked on each side of zero will quickly show the acceptableness of the product, in comparison with the master cam.





Selecting and Processing Steels for Lamination Dies

By Lester F. Spencer

CHIEF METALLURGIST
LANDERS FRARY & CLARK

Part II

ANNEALING IS PERFORMED either for (1) the removal of strains set up in previous operations such as forging or rolling; (2) to improve machinability; or, (3) to render the analysis more responsive to even hardening. In general pack annealing is recommended in order to prevent excessive scaling and insure slow cooling. The annealing temperature is usually 1650 deg F followed by a controlled cooling, usually suggested as a 50 degree per hour drop until 1000 degrees is reached, after which the steel can be cooled more rapidly. A hardness of not more than 228 Brinell should be realized. It has been suggested[4] that a re-heat be incorporated within the annealing cycle to insure maximum softness in type 3 composition steel—heat to 1650 deg F, soak and allow steel to furnace cool to approximately 1000 deg F; re-heat to 1425 deg F and then cool slowly within the furnace.

Pack hardening is done to a considerable extent especially when air is employed as the quenching medium, or when the working surfaces of the die are to be used without grinding after the heat treatment. The pack material can be either a neutral material such as cast iron chips, mica, etc., or a carburizing compound. The use of the latter makes it possible to increase the surface content of the steel by as much as 0.50 percent carbon[1] if the steel is held for 3 hours at 1800 deg F. Increasing the

Table III

The Effect of Mass on the Hardness obtained from two High Carbon-High Chromium Die Steels; Specimens 4 inch cube. (4)

Steel	Method of Heat Treat.	Quench Temp. °F	Brinell Hardness Location Numbers (see figure above)										R_c hardness location numbers	
			1	2	3	4	5	6	7	8	9	10	1	2
'A'	Air	1925	627	627	—	—	—	627	627	—	—	627	61	61
'A'	Air	2000	627	627	—	—	—	627	627	—	—	627	61	61
'A'	Oil	1925	652	—	—	—	—	652	652	—	—	652	63	63
'B'	Air	1800	424	418	387	387	375	364	402	387	387	364	45	42
'B'	Air	1950	477	444	444	—	—	418	444	—	430	418	49	47
'B'	Oil	1800	713	713	—	—	—	713	713	—	—	713	66	66

carbon content of the surface is desirable on applications where wear is the only factor such as in deep drawing dies, however, in lamination dies, this condition may cause edge crumbling during service and is not recommended. Either salt bath or atmospheric controlled furnace can be used without decarburization of the steel; either method being dependent upon strict metallurgical control.

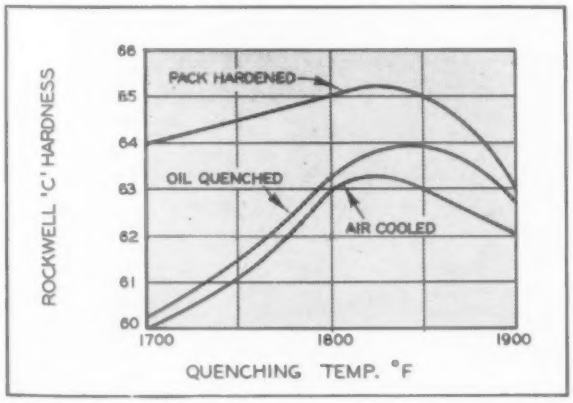
Pre-heat Recommended

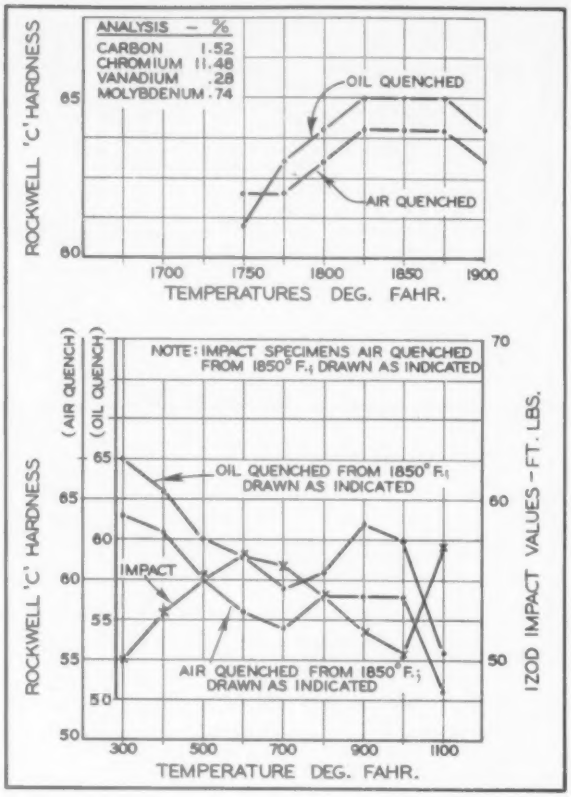
A pre-heat of approximately 1200 to 1250 deg F is suggested for all types in order to cut down on the soaking period required by the high heat. Types 1 and 2 are heat treated to 1750 deg F and either oil or air quenched after a sufficient soak at the hardening temperature. The inclusion of molybdenum in types 2, 3 and 4 permits these compositions to obtain full hardness upon air cooling. Types 3 and 4 have slightly higher hardening temperatures, these ranging from 1800 to 1850 deg F. However, it is necessary to observe the length of time at soak for these compositions since grain growth may occur which will result in a decrease in the toughness of the material even after it is properly drawn. Whether air or oil quenching is employed, it is necessary to place the item hardened within the tempering furnace before it has cooled down to approximately 200 deg F.

Quenching Mediums Affect Hardness

The effect of different quenching mediums upon the hardness of a steel of type 3 containing 1.50 percent carbon, 12.00 percent chromium and 1.00 percent molybdenum[1] is indicated in Fig. 1. Pack hardening induces some carburization which results in the highest "as quenched" hardness, and both the oil and air hardening specimens was materially the same until a temperature of 1800 deg F is reached. In Table III there is indicated the effect of mass on the hardness obtained on two high carbon-high chromium steels at various quenching temperatures.

Effect of quenching medium, pack hardening in carburizing medium and quenching temperature on the hardness of a 1.5 percent carbon high carbon-high chromium steel (ref. 1), type 3.

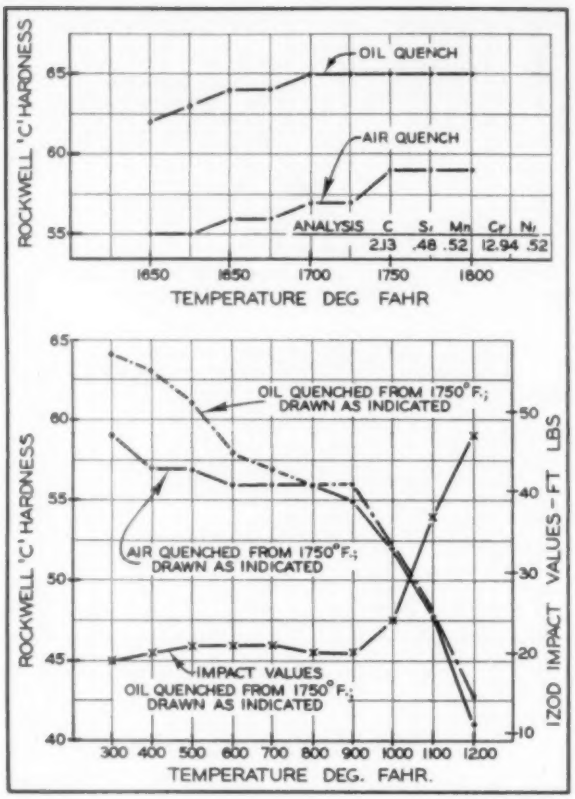




Work in the heat treatment of modified type 1 and type 3 steel compositions in an atmosphere furnace was performed. Compositions of the material used along with hardness data are indicated in Table IV. The Lindberg HY-2 atmosphere plus Chicago city gas was used with a total furnace time of 1¼ hr. Both types were treated for the same length of time and quenched in identical mediums, the only difference being that type 1 was quenched from 1750 deg F while type 3 was quenched from 1850 deg F. Type 1 had a draw temperature of 450 deg F for a period of 2 hours and type 3 had a draw temperature of 750 deg F for a period of 2 hours.

Heat Slowly for Tempering

In tempering, it is suggested that the item be slowly heated to the required temperature; for lamination dies, this temperature does not usually exceed 550 deg F. The time at the tempering temperature will vary with the size of the section, however, it is generally accepted that a period of 2 hours per each inch of the thickest section is sufficient. Cool in still air after immersion from the furnace. Of interest as illustrated in Fig. 2 and 3 is a comparison of both types 1 and 3 when quenched in oil and in air. Also illustrated is the comparative Rockwell hardnesses and impact properties of the two types mentioned in relationship to the tempering temperature.


ROCKWELL 'C' HARDNESS
OIL QUENCH
AIR QUENCH
ANALYSIS C Si Mn Cr Ni
2.13 .48 .52 12.94 .52
1650 1650 1700 1750 1800
TEMPERATURE DEG FAHR
OIL QUENCHED FROM 1750°F.; DRAWN AS INDICATED
AIR QUENCHED FROM 1750°F.; DRAWN AS INDICATED
IMPACT VALUES OIL QUENCHED FROM 1750°F.; DRAWN AS INDICATED
IZOD IMPACT VALUES-FT LBS
300 400 500 600 700 800 900 1000 1100 1200
TEMPERATURE DEG. FAHR.

Some Harder to Machine

All of the high carbon-high chromium steels are more difficult to machine than the lower alloy grades, however, difficulties may be lessened by using proper tools at relatively slow speeds and heavy speeds. When filing, experience[9] has shown that dragging the file back over the work, even slightly, glazes the work and makes further filing exceedingly difficult. A sharp file should be used applying heavy pressure on the forward stroke. The surface of the work should be kept dry as even moisture from the hands causes difficulty. For rough filing, a 8¾ inch, 3 square '00' cut file is recommended, whereas for finish filing a 6½ inch, needle '0' and '1' cut file is recommended. For sawing, a sharp blade should be used, taking care that the blade does not drag or cut on the back stroke. Low speeds and heavy feeds should be used, and, as is the case in machining, avoid the use of lubricants. A dull saw should never be used because it is very difficult to start a new blade if the work once begins to glaze.

In grinding operations, a free-cutting wheel should be utilized to prevent localized over-heating. Because of the abrasive qualities of these steels, the grinding wheel manufacturer should be consulted with regard to the proper grit and grain to be used. In addition, it should be remembered that the value in tool steels is the retention of a hard wear-resistant surface; thus it is not wise to have too close an allowance between finished size of the tool required and bar size purchased. Allowances for mill decarburization must be made, particularly when hot rolled or hammered bars are purchased, and in those cases, the recommended stock removal from surface diameters or thicknesses is indicated in the following table. Where bar stock is turned, it is well to have the section well centered so that there is an even cut on the diameter of the stock.

Diameter or Thickness	Amount to be removed from surface
up to and including ½ in.	1/64 inches (0.016)
½ to 2 inches	1/32 inches (0.032)
2 to 3 inches	1/16 inches (0.062)
3 to 5 inches	⅛ inches (0.125)
over 5 inches	3/15 inches (0.1875)

Another precaution that should be observed is that all incoming material be properly identified and segregated so that there may be no doubt as to the identity of the material when it is used. In many instances, failure to respond to heat treatment can be traced to the utter disregard for this precaution. Deep stamp marks should be avoided since they may prove to be focal points of weakness either in heat treatment or in service.

References

1. "Tool Steels", J. P. Gill, R. S. Rose, G. A. Roberts, H. G. Johnstin, and R. B. George, American Society for Metals, Cleveland, Ohio, 1944 ed.
2. "U.S.S. Electrical Steel Sheets", Carnegie Illinois Steel Co., Pittsburgh, 1941 ed.
3. "Latrobe Tool Steels", Latrobe Electric Steel Co., Latrobe, Pa.
4. "Tool Steels", Vanadium Alloy Steel Co., Pittsburgh, Pa.
5. "Increasing the Life and Accuracy of Lamination Dies", G. M. Shingledecker, *Iron Age*, May 3, 1945.
6. "Bethlehem Tool Steels", Bethlehem Steel Co., Bethlehem, Pa.
7. "Allegheny-Ludlum Magnetic Core Materials", Allegheny-Ludlum Steel Corp., Pittsburgh, Pa.
8. "Selection of Cold Work Die Steels", G. M. Butler, *Steel Processing*, April 1946.
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Table IV

Chemical Composition	Steel A	Steel B
Carbon	2.20%	1.60%
Silicon	0.50	—
Manganese	0.50	—
Chromium	13.20	12.50
Nickel	0.50	—
Vanadium	—	1.00
Molybdenum	—	0.80

No	Quench	Rockwell Hardness 'C' As Quenched	(converted from 30N) Tempered
A1	Atmosphere	63 to 64	—
A2	Air	61 to 63	59 to 60
A3	Oil	66 to 68	61 to 63
B1	Atmosphere	63 to 64	—
B2	Air	63 to 64	57 to 59
B3	Oil	62 to 64	57 to 58

Criteria for Selection of Production Milling Methods

By Robert A. Winblad

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THE CINCINNATI MILLING MACHINE COMPANY

BEFORE DISCUSSING THE criteria for selecting milling methods, it is helpful to clarify the meaning of the term "production milling."

"Production milling is the application of milling equipment to the manufacture of both large and small quantities of parts, with the objective of obtaining a high rate of production and high dimensional accuracy which will permit interchangeability of parts at a minimum unit cost."[1]

In order to arrive at an economically convenient solution for any production job, a number of factors must be considered. Since trying to establish a comprehensive list of all these factors would be a formidable task, attention is directed only to factors which we consider of major importance.

The first factor to be considered is the required rate of production. This may mean the rate for a job which is run continuously, or for a job which will run intermittently and thus allow free machine time for other work.

Despite its importance, this factor is one on which information is often most difficult to secure. The most common answer to the question, "What production is required?" is "Well, give me the most you can," or the brief word "maximum", which leaves unanswered the questions, "Maximum from what machine—with what tooling—with what operator attendance—at which operator efficiency—at what price?"

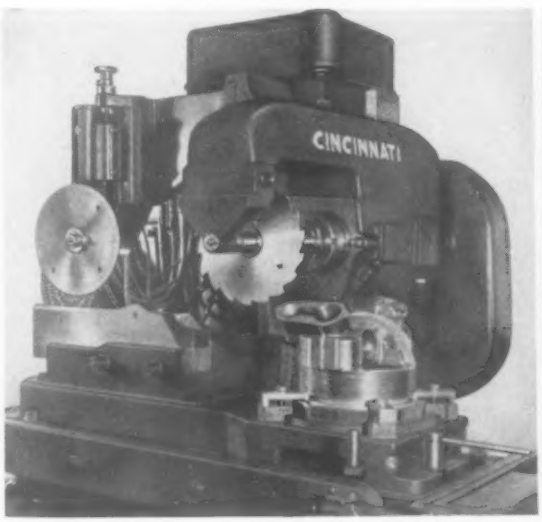
The machine rate of production should exceed the required production, not only by the rated efficiency of the operator, but also by the amount of several other factors materially affecting the net result.

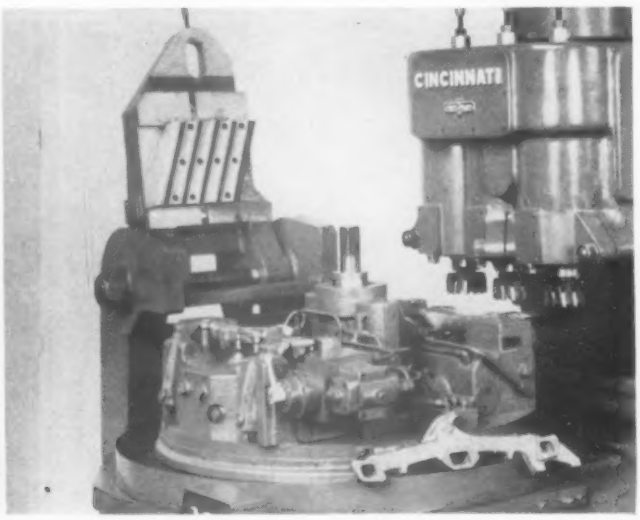
Downtime of a machine is the amount of time the machine is idle when changing cutters for resharpening. The frequency depends on the cutter life. To reduce this production loss to a minimum, care

Presented at Annual Meeting, American Society of Tool Engineers, March 16, 1951.

1 "A Treatise on Milling and Milling Machines"

Fig. 1. (left) Adaptation of standard tracer controlled milling machine for milling fins in forged cylinder heads. Fig. 2. (right) Closeup of fixtures and broach tools on a special "combined operation" machine for milling and finish broaching automotive exhaust manifolds.





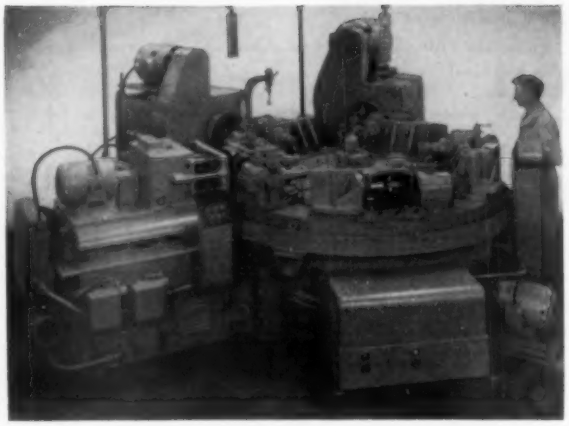


Fig. 3. Special "combined operation" for rough and finish milling joint face of automotive transmission case. Dowel holes drilled and reamed on same machine.

should be taken to select the proper cutter and cutter speed.

Total production, in order to meet the problem, must take into account all the above factors. Gross production less the losses of downtime, set-up time, and inefficiency gives the net or usable figure.

The next problem is to determine the required or best milling method. This term is a composite of the selection of machine, cutters and fixtures needed.

A characteristic feature of production milling is that the equipment for such work may be in use for long periods of time on the same operation. Therefore, semi-automatic or full automatic operation of both fixture and machine is often necessary to reduce operator fatigue and meet the required production rate. Also, there is an increasing tendency to combine different types of operations, such as milling and drilling; such planning deserves careful consideration.

Machines, fixtures, cutters, and related equipment must be selected according to the nature of the operation to be performed. The general characteristics of the workpiece will, in some measure, dictate the size and power of machines required. The power required is a direct function of the *amount* of metal to be removed and the *rate* at which it must be removed. This latter consideration is directly related to the rate of production.

Standard Machines

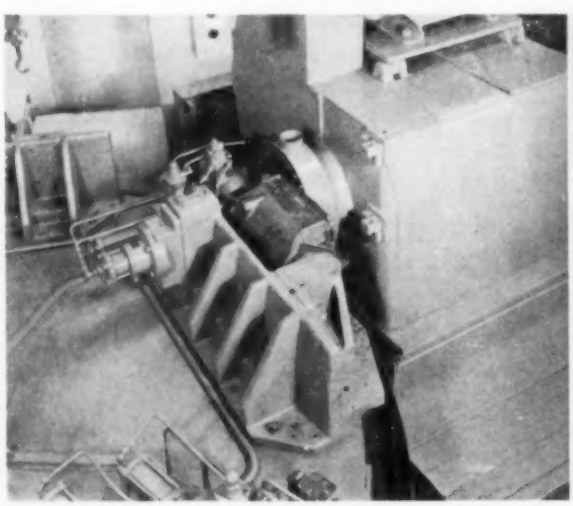
Production milling jobs are performed to a large extent on standard machines. This is more satisfactory to most users of production equipment since it allows flexibility in the use of the machines.

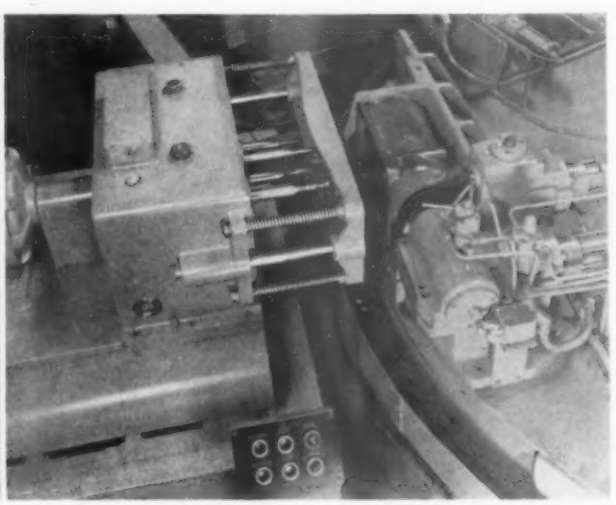
In times of emergency, it is an advantage to do initial tooling, insofar as is possible, on standard machines. They are more readily available and, in the initial phases, flexibility is necessary because design changes are often made while tooling is still in process, and cost of special machines might prohibit immediate adoption of such changes.

Experience has indicated that special machines very often develop from an original adaptation of standard equipment. Development of the machines for milling fins on forged cylinder heads for aircraft engines is a typical example. After the initial experimental setups proved the feasibility of this machining method, the first production machines were made, as shown in Fig. 1. These were an adaptation of standard tracer controlled hydromatic milling machines with special tooling. Later a special machine was developed for higher production as demand for this item increased. With surprising frequency, the reverse of the above also proves true. Machines developed for special applications will change, grow and improve to become a standard product.

In considering standard machine applications, there are several basic milling methods which are employed: Single-piece milling with one or more spindles; string milling; reciprocal milling; box

Fig. 4. (left) shows milling cutter and fixture arrangement on machine shown in Fig. 3. Fig. 5, at right, illustrates arrangement of head for drilling and reaming dowel holes on machine shown in Fig. 3.





milling; progressive milling and many others.

A detailed discussion of the methods of milling and their application is made in Chapter 17 of a new book published by The Cincinnati Milling Machine Co. entitled "A Treatise on Milling and Milling Machines." Each application is suitable for the particular work-piece and operation being performed. It is quite possible to propose a more productive method, but probably not for the same amount of investment or with a method which is equally suited to the job requirements.

Special Machines

As production requirements increase, the problem of satisfying them becomes more difficult. The competitive market demands a lower cost per piece, which, in an era of increased labor and material costs, and with floor space at a premium, means that the equipment must have more to offer.

In the development of the special machines, it was necessary in each case to combine operations, reduce operator attendance, and provide a convenient method of work handling.

Fig. 2 shows the automatic indexing type of combined operations machine—a 180 deg indexing, ram-type milling machine, on which a finish broaching cut is obtained during the index cycle.

Another sequence (Figs. 2 through 5) shows an indexing combined operations machine for rough and finish milling with cutter heads, as shown in Fig. 4. In the same machine dowel holes are drilled and reamed, as shown in Fig. 5. A second machine used for machining the same part, performs multiple milling operations. The fixtures are hydraulic-clamping to decrease operator fatigue.

Machines are also supplied for the line transfer type of operation. In the machine shown in Fig. 6, automotive cylinder heads, both right-hand and left-hand, were milled, drilled, tapped and spot faced on the top surface. Fig. 6 shows the arrangement of the milling cutters on the ram at the right-hand end.

Another type of transfer machine, the tunnel or through transfer machine, is shown in Fig. 7.

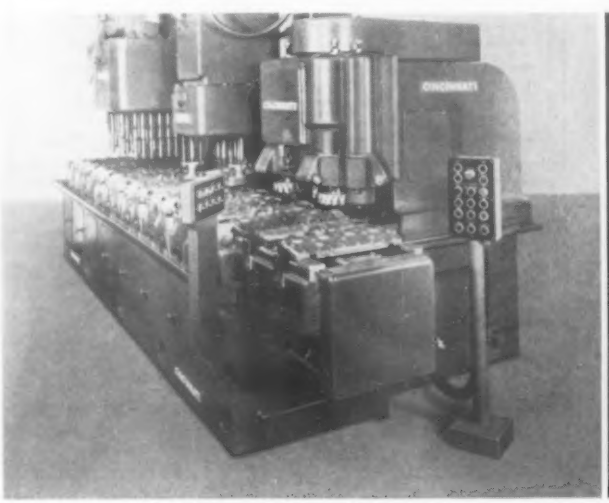
The ability of a machine to pay for itself through the savings it makes possible, is a paramount criterion in the thinking of production equipment users. Economic factors, tax structures, accounting procedures, and evaluation of features of new equipment over old equipment are receiving more and more attention. Many companies had no sound, consistent system of evaluation. One method of evaluation which is becoming more widely known every day is the one proposed by the Machinery and Allied Products Institute and known as the MAPI Formula. This provides a yardstick for comparison of present against proposed equipment and gives the seller, as well as the user, some idea as to the advisability of replacing old equipment. It can also be used to compare the relative values of several types of new equipment or as a comparison of one method against another.

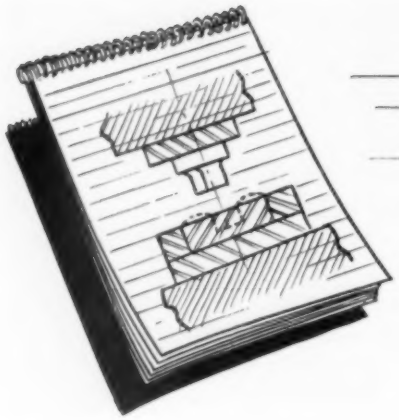
Summarizing, in making recommendations for production milling methods, the following items must all be considered:

(1) What is the required production?
(2) What is the type of operation?
(3) What is the material and stock removal?
(4) What machine, cutters and fixtures should be selected?
(5) What are the economic factors involved?

But most important, it is through the use of ingenuity and the proper application of the factors discussed that lower production costs can be made possible.

Fig. 6. Work and cutter spindle arrangement on line transfer "combined operation" machine for automotive cylinder heads. Fig. 7. View of cutters and work transfer arrangement of "tunnel type" machine for milling ends of automotive fly wheel housing.





A notebook on die design....

Conclusion

By John S. Brozek
SARGENT AND COMPANY

19. Hardened Plate Under Punch Plate

Construction of this type is often required in order to keep small punch heads from pounding into the punch holder, resulting in eventual fracture of the head, causing the punch to pull out.

Reference—Item 18.

20. Punches Closely Spaced

Where space in the "stripper" or "die" does not permit bushings, an insert such as shown in Item 18 should be provided. Location of holes in stripper bushing and die should be corrected by jig grinding for extreme accurate work.

21. Wire Punches

Punches of this type are made from drill rod with upset heads, will stand up provided holes pierced are twice stock thickness.

22. Spring Pins in Piercing and Blanking Punches

Wherever possible, spring "kicker pins" should be provided in piercing punches. This eliminates the tendency of slugs to pull up and prevent feeding the strip.

Before hardening of blanking punches, it is well to drill a hole somewhere in which can be inserted a spring pin in cases where blank has a tendency to pull up.

23. Pilots, Removable and Spring

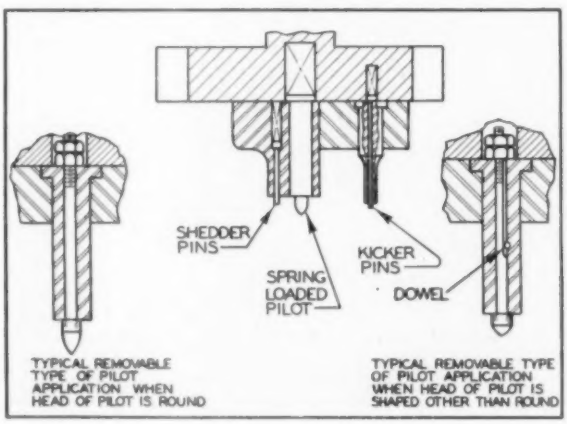
The best practice in die design is to have removable pilots to facilitate grinding of punches.

Sometimes it is necessary to have springs behind pilots for various reasons, namely, where thin-walled pilot holes are required in blanking punches. The purpose of this is to eliminate punch breakage when misfeeds occur. The spring pilot depresses itself if the pickup hole is not properly located under the blanking punch. Refer to Item 22.

24. Types of Strippers

There are basically two types of strippers, fixed and spring. The primary function of any stripper is to strip the punches of material after piercing, blanking, hold down material for forming, drawing and guiding punches where required.

Make the spring stripper of ample width and length to provide room for additional springs if necessary. Also make it thick enough to properly take care of the stripper bolts which sometimes loosen up. If some of the punches are to be guided in the stripper it must be supported on guide posts and accurately held in line. When punches are not guided in the stripper, ample clearance must be allowed around all the smaller punches to avoid the possibility of their being thrown out of line. If there are one or two good sturdy punches in the die, fit the stripper close to these (0.001 to 0.005 in. clearance), and allow 0.010 or 0.015 in. clearance on the smaller punches. Refer to Item 18.


SHEDDER PINS
SPRING LOADED PILOT
KICKER PINS
DOWEL
TYPICAL REMOVABLE TYPE OF PILOT APPLICATION WHEN HEAD OF PILOT IS ROUND
TYPICAL REMOVABLE TYPE OF PILOT APPLICATION WHEN HEAD OF PILOT IS SHAPED OTHER THAN ROUND

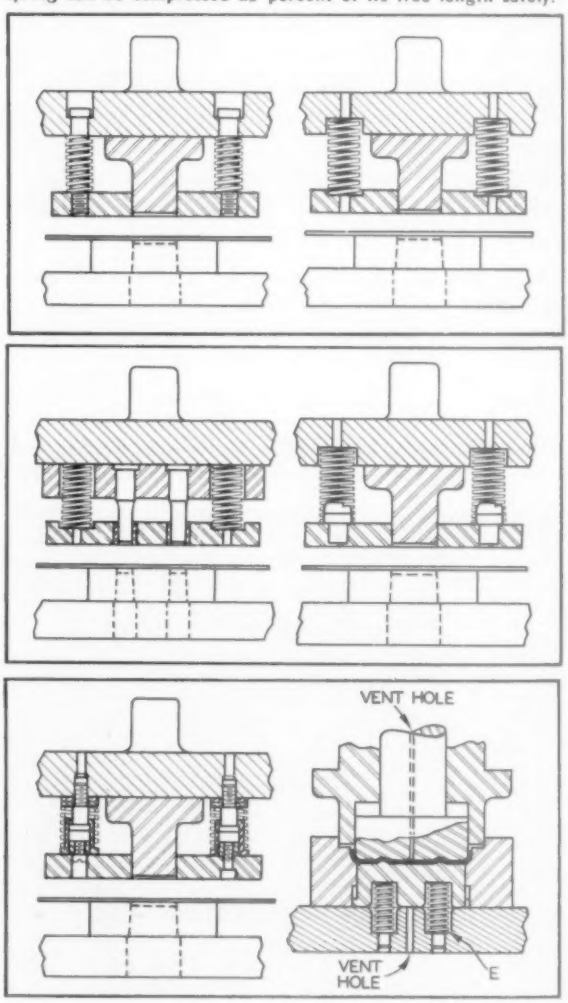
25. Stock Guides

The material should be guided, the length to be twice the width before the first operation. Various construction can be used to suit requirements, namely, rollers, springs or the stock guide, can be built in as part of the regular setedges mounted on the die proper.

26. Springs

Spring failure is common, but when springs of ample length and strength are used, little trouble will be encountered.

It is important that the selection of springs used be carefully selected in relation to the service for which they are intended. Basically, there are two types of springs made that can serve the needs for all die working purposes: medium pressure high deflection, and high pressure medium deflection. In addition to this, the oval type wire springs are made for limited space and area which will withstand ¼ in. maximum deflection at high speed and ½ in. deflection at low speed. The average spring can be compressed 25 percent of its free length safely.



Various Types of Spring Applications

Fig. 1. Placement of die springs around stripper bolts, although widely used, is not recommended for high-grade dies.
Fig. 2. Counterbored holes in the two plates serve as spring pockets.
Fig. 3. Through holes are machined in the punch plate of a piercing die.
Fig. 4. Standardized pilots reduce cost in machining the stripper plate.
Fig. 5. "Strippit" die spring units can be applied in two ways: left—the capscrew merely prevents sidewise movement of the unit; right—the capscrew holds the locating plug.
Fig. 6. Stripper springs are entirely confined when the pressure pad bottoms, and hence the openings must have a large chamfer and safety pins. "E" prevent broken coils from getting between pressure pad and die holder.

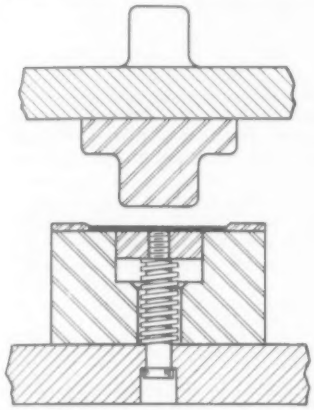


Fig. 7. Die springs, surrounding shoulder bolts, support the pressure pad. Since the pad bottoms, the spring-confining hole must be adequately chamfered to avoid pinching the coils.

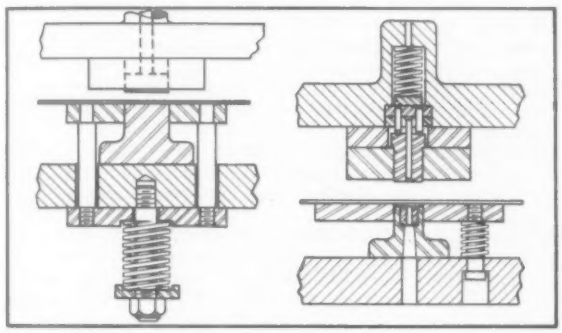


Fig. 8. In an inverted die, operation of the stripper plate is achieved with a compression spring and pins "A".
Fig. 9. A spring-actuated knock-out strips the part and also serves to guide the slender piercing punch.

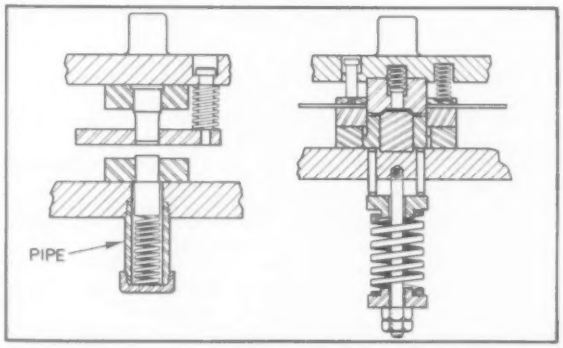


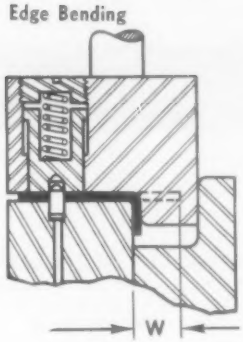
Fig. 10. When there is no room within a die holder for die springs, a housing is screwed into a tapped hole, and the confined spring actuates the knockout.
Fig. 11. A blank and form compound die showing hold-down spring loaded pin, to eliminate creeping in forming, with spring coil on bottom of die set, with dowel pin to return formed part with forming block.

Check Points for Forming and Bending Die Design

1. Bending Operations

Bending operations are classified into three catagories: edge, "V" and channel bending. To bend any metal into desired shape, it must be subjected to stresses in plastic range of material being worked. It is assumed that the compression stresses at the inside of a neutral plane of the bend and the tension stresses at the outside are equal to the ultimate tensile strength of the metal being worked.

Edge Bending



Formula:

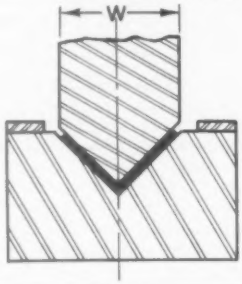
$$P = \frac{LT^2}{2W} S$$

Where:
P = Bending Force, Tons
L = Length of Bend, Inches
T = Stock Thickness, Inches
W = Width of Unsupported Metal, Inches
S = Ultimate Tensile Strength of Metal, Tons Per Square Inch

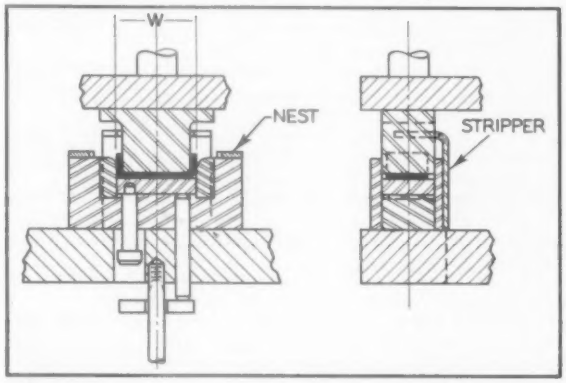
V Bending
Formula:

$$P = \frac{LT^2}{W} S$$

Note: "W" = Width of Opening in V Die



Channel or U-ing Die



Formua:

$$P = \frac{2LT^2}{W} S$$

Note: "W" = Width of Opening in U-ing or Channel Die.

In addition to calculating the required bending pressures, pad pressure, namely, spring, rubber or die cushion resistance must be added to the above formula for correct tonnage required to bend or form up the given part.

Note: For quick calculation and checking purposes, the following formula is sometimes used for finding bending pressure requirements:

$$P = 0.25\ LT\ S$$

2. Proper Nest Height for "Hand Feed Operations"

Whenever possible design locating nest three to four times the blank thickness, with the top well rounded to receive the part. The proper condition here will increase production 10 to 25 percent.

3. Air Ejection

In all cases, provisions should be made to blow out pieces from the die, as this reduces handling time about 35 percent. Care must be exercised in positioning die in die set so that when blowing out the blanks it would not hit the die pins and rebound on to the forming block.

4. Spring Pressure in Pad Forming Dies

When proper spring pressure is not applied when bending or forming, creeping results in parts formed, causing a variation of dimension in excess of product tolerances.

5. Maintaining Squareness

In order to obtain parts within close angular tolerances, a projection or gusset must be ground onto the forming punch to set the metal upon bottoming of the punch and carrier pad.

In addition to the above, sometimes a slight angle must be ground to allow for over bending the part to bring angle up to correct angular requirement.

6. Wear Sections on Forming Dies

Inserts should be incorporated into forming dies where wear from abrasive action is likely to result. At the same time, it allows for minor adjustments when required or replacement of same with little, if any, cost.

Refer to Item 5.

JIC Pneumatic Standards for Industrial Equipment

Glossary of Terms Used in These Pneumatic Specifications

Actuator: A device to convert fluid energy into mechanical motion.

Air: Air as referred to in these standards means the pressure medium for pneumatic applications.

Automatic Controls: Those actuated in response to the cycle of the equipment.

Back Connected: Where piping connections are on normally unexposed surfaces of pneumatic components.

Channel: An air passage the length of which is large with respect to its cross section dimension.

Circuit: An arrangement of component parts or pneumatic equipment interconnected to a specific appliance or appliances.

Cleaner: A device for the removal of solids from a fluid wherein the resistance to motion of such solids is in a straight line.

Compartment: A space within the base, frame, or column of the equipment.

Compressor: A device for converting mechanical energy into air energy.

- Fixed Displacement: A compressor which delivers a relatively constant volume of air per cycle.
- Variable Displacement: A compressor in which the volume per cycle can be varied.

Cylinder: A linear motion device in which the thrust or force is proportional to the effective cross sectional area and to the pressure differential.

Cylinder, Single Acting: A cylinder in which the air pressure can be applied in only one direction.

- Plunger Type: A cylinder in which the internal element is of a single diameter, and upon which the seal applied is of the contracting type.
- Piston Type: A cylinder in which the internal element is of one or more diameters, and the seal is of the expanding type.

Cylinder, Double Acting: A cylinder in which air pressure can be applied in either direction.

- Single End Rod: A cylinder with a rod extending from one end.
- Double End Rod: A cylinder with two rods, one extending from each end.

Enclosure: A housing for pneumatic apparatus.

Filter: A device for the removal of solids from a pneumatic system wherein the resistance to motion of such solids is in a tortuous path.

Fluid: Any material that will take the shape of the container in which it is placed.

Front Connected: Where piping connections are normally on exposed surfaces of pneumatic components.

Pneumatic Panel:

1. Pneumatic Mounting Panel
   A plate on which may be mounted a number of pneumatic actuating components.
2. Pneumatic Control Panel
   A grouping of pneumatic control units mounted to form one assembly on a plate, or in a casting, and having a single mounting surface.

Line: A tube, pipe, or hose which acts as a conductor of air.

Line, Exhaust: A return line which carries power or control actuating air back to the atmosphere.

Line, Joining: A line which crosses or connects with another line on a diagram and which also connects in construction. The junction of the lines shall be indicated by a dot which must be at least three times the width of the line.

Line, Passing: A line which crosses another line on a diagram, but which does not connect in construction. Line on a diagram to have no swell at crossing.

Line, Pilot: A line which acts as a conductor of control actuating air.

Line, Working: A line which acts as a conductor of power actuating air.

Lubricator: A device for adding lubricant to the actuating medium.

Manual Controls: Those actuated by the operator, regardless of means.

Mass Production: For a model run, or an indefinite period of time.

Motors and Cylinders: Devices for converting air energy into mechanical energy.

Motor, Oscillating: A motor producing a maximum angular rotative movement of less than 360 deg in either direction.

Motor, Rotary: A motor producing rotary motion having torque output proportional to the displacement per revolution and to the pressure drop between intake and exhaust ports.

Motor, Rotary, Fixed Displacement: A rotary motor in which displacement per revolution is not adjustable.

Motor, Rotary, Variable Displacement: A rotary motor in which the displacement per revolution is adjustable.

Muffler: A device for reducing exhaust noises.

Passage: A machined or cored connection which lies within or passes through a pneumatic component, and which acts as a conductor of air.

Phase of Cycle: 0. Neutral
1. Rapid Advance
2. Feed or pressure stroke (forward and return)
3. Dwell
4. Rapid Return

Phase of Cycle:

- Rapid Advance: The approach of the tools or workpiece to the feed position.
- Feed: The portion of the cycle where work is performed on the workpiece.
- Dwell: The portion of the cycle where the feed rates or pressure stroke is stopped.
- Rapid Return: The return of the tools or workpiece to the cycle starting position.

Port: An opening at a surface of component; e.g., terminus of a passage. May be internal or external.

Port, Valve: A controllable opening between passages; e.g., one which can be closed, opened, or modulated.

Positive Position Stop: A structural member which definitely limits the working motion at a desired position.

Positive Safety Stop: A fixed structural member which confines maximum travel within the design limits of the machine or equipment.

Pressure-Time Diagram: A graphical presentation of pressure in pounds per square inch plotted against time for a complete cycle of the equipment.

Restriction: A device which produces a deliberate pressure drop or resistance in a line or passage by means of a reduced cross-sectional area.

- Choke: A restriction, the length of which is relatively large with respect to its cross-section dimensions.
- Orifice: A restriction, the length of which is relatively small with respect to its cross-section dimensions.

Schematic Diagram: A drawing or drawings showing the functional construction of all valves, controls, and actuating mechanisms.

Sealing Device: A part or assembly of parts used to prevent leakage between two or more other parts.

Formulated by the Joint Industry Conference which includes representatives of the following: Hydraulic Equipment Manufacturers, Industrial Equipment Users, National Machine Tool Builders' Association, Packing and Seal Manufacturers, Pneumatic Equipment Manufacturers, Press Manufacturers, Tubing and Fitting Manufacturers.

Separator: A device to separate water or other materials of different specific gravities from the actuating medium.
Sub-Plate (Back Plate): An auxiliary mounting for a pneumatic actuating component to which piping connections are mounted.
Surge: A transient rise of air pressure in the circuit.
Symbolic Diagram: A drawing or drawings showing by means of approved standard symbols each and every piece of pneumatic apparatus including all inter-connecting lines.
Trip Device: A mechanical element for the actuation of a position control.
Unit Production: One piece per set-up.

Foreword

The term "Industrial Equipment" referred to in these Pneumatic Standards for Industrial Equipment not only applies to machine tools coming within the following definitions:

(A) "A metal cutting machine tool is a power-driven machine not portable by hand, used for the purpose of removing metal in the form of chips,"

(B) "A metal-forming machine tool is a power-driven machine, not portable by hand, used to press, forge, emboss, hammer, blank or shear metal,"

But also applies to other types of industrial equipment which are not generally classified as "machine tools" but which are air actuated.

NOTES:

The prefix letter "A" is used throughout these standards to denote its applicability to pneumatic equipment.

Where the letters "JIC" are used they refer to Joint Industry Conference.

Proposals for changes in these JIC Standards are considered at meetings of the Joint Industry Conference which are held at intervals for this purpose.

A0 GENERAL

A0.1 (a) The purpose of these standards is to provide specifications for the application of pneumatics to industrial equipment which will promote safety of personnel, uninterrupted production, long life of the machine, equipment or tool, and will not limit or inhibit advancement in the art of pneumatics.
(b) Where new developments in pneumatics will perform in a manner equal to these specifications they will be considered as equivalent.

A0.2 These standards are proposed to cover pneumatic equipment in general applications. Any exceptions to these standards will be as agreed upon between supplier and purchaser.

A0.3 The purchaser shall specify such additional details as are needed to meet unusual operating conditions.

A0.4 (a) The builder shall submit necessary performance specifications on pneumatic equipment, including symbolic or schematic diagrams in accordance with paragraph A1.1.4 (a) for purchaser's approval. Final diagrams and text shall conform to the pneumatic equipment shipped.
(b) Part numbers shall be provided for all types of pneumatic equipment. Seal manufacturer's catalog number shall also be provided where sealing devices are commercially available.

A0.5 All pneumatic equipment shall be installed and used in accordance with the recommendations of the manufacturers thereof.

A0.8 All industrial equipment at the completion of assembly and before shipment shall be given complete performance tests to determine conformity with equipment specifications. There shall be no evidence of external leakage.

A0.9 A pressure-time diagram taken under operating conditions including data concerning maximum rate of pressure rise shall be furnished when specified on purchase order.

A0.10 Pneumatic equipment shall be of proven engineering design, fabricated of material of accepted quality and with workmanlike finish; and must be capable of performing efficient, reliable service in the installation for which it is provided.

A0.11 Pneumatic equipment and piping shall be accessible and mounted in a position that will not interfere with machine adjustments or maintenance of electrical, hydraulic, or mechanical equipment. (See A2.6.3; A4.2.6 and A6.3.4).

A1 DIAGRAMS

A1.1—Circuit Diagrams

A1.1.1 (a) Symbolic Diagram—A drawing or drawings showing by means of approved standard symbols each and every piece of pneumatic apparatus, including all interconnecting lines.
(b) Schematic Diagram—A drawing or drawings showing the functional construction of all valves, controls, and actuating mechanisms including all interconnecting lines.

A1.1.2 Symbolic Diagrams
(a) Symbolic diagrams shall be furnished with industrial equipment. (Schematic diagram acceptable.)
(b) A copy of the diagram shall be firmly attached to the inside cover of the pneumatic control enclosure or pneumatic diagram enclosure, either by adhesive material or by permanent data pocket or clip.

A1.1.3 Schematic Diagrams
(a) When requested on purchase order, a schematic diagram shall be supplied.
(b) When requested on purchase order, a schematic diagram shall show and describe the flow paths for each phase of each complete cycle.
(c) When requested on purchase order, a schematic diagram shall show in color only those portions of the circuit which are functioning at each single phase of the cycle. (See A1.4.)

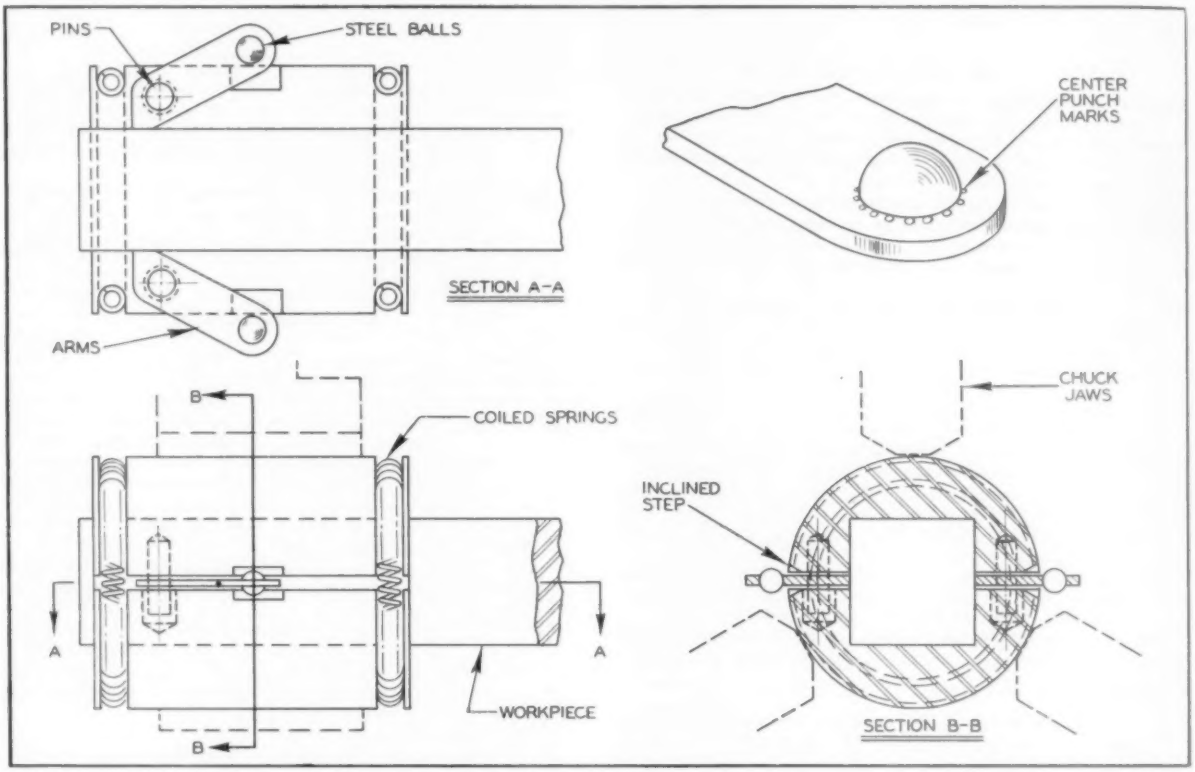
A1.1.4 All Diagrams
(a) The descriptive text shall explain the function of all components of the circuit and the sequence of the operations. Either the diagram or descriptive text shall include, in addition to the sequence of operations, the following when applicable:
1. All pneumatic equipment shall be identified. When possible, catalog number and manufacturer's name shall be shown.
2. Size of piping.
3. Diameters of pistons and rods, length of stroke, and estimated required force of cylinders when other than maximum pressure is applied.
4. Time of cycle, when pertinent. (For example: Time range of cycle exclusive of loading.)
5. Operating pressures.
6. Horsepower and rpm of each pneumatic drive.
7. Delivery and consumption in cubic feet of free air per minute.
8. Storage or surge tank capacity in cubic feet.
9. Displacement, speed range, and torque rating of each pneumatic motor.
10. Data or text, or both, shall show operations performed and characteristics of any actuating electrical equipment used.

(b) The related text and the diagram shall be shown on the same or facing pages.
(c) All diagrams shall be marked with serial number or with the purchaser's order number of that equipment, or, if none, with some other symbol which will identify the particular apparatus to which the diagram applies.

Gadgets

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

Split Bushing for Chucking Square Bars



A split bushing, such as shown, permits square bars to be held in a 3-jaw chuck.

A quantity of square section bars had to be turned in a lathe not fitted with square collet equipment, and it was decided to grip these in the three-jaw chuck by means of a split bushing having a square axial hole. This worked quite well except that the two halves of the bushing had to be picked up from the lathe tray every time a fresh bar was chucked. To avoid this, the two halves were held together by means of endless coil springs housed within grooves at either end of the bushing exterior.

In order to force apart the two halves when threading onto the end of a bar, a pair of separators were fitted to the bushing. These consisted of two swivelling arms, each hinged on a pin and having an ordinary steel ball enclosed in the outer end.

When the two arms are swivelled in toward the bushing axis by means of finger pressure, the balls are forced between the two halves of the bushing, overcoming the spring pressure and forcing the halves apart. The bushing can then be slipped off one shaft and onto another. An inclined step on each bushing half facilitates entry of the balls. The heels of the swivelling arms bear on the square bar exterior and are thus held in the correct position for pressing with the fingers. The balls are retained loosely in the ends of the swivelling arms by means of a few centre punch marks.

Tom Brown
Middlesex, England

To Simplify Tapping

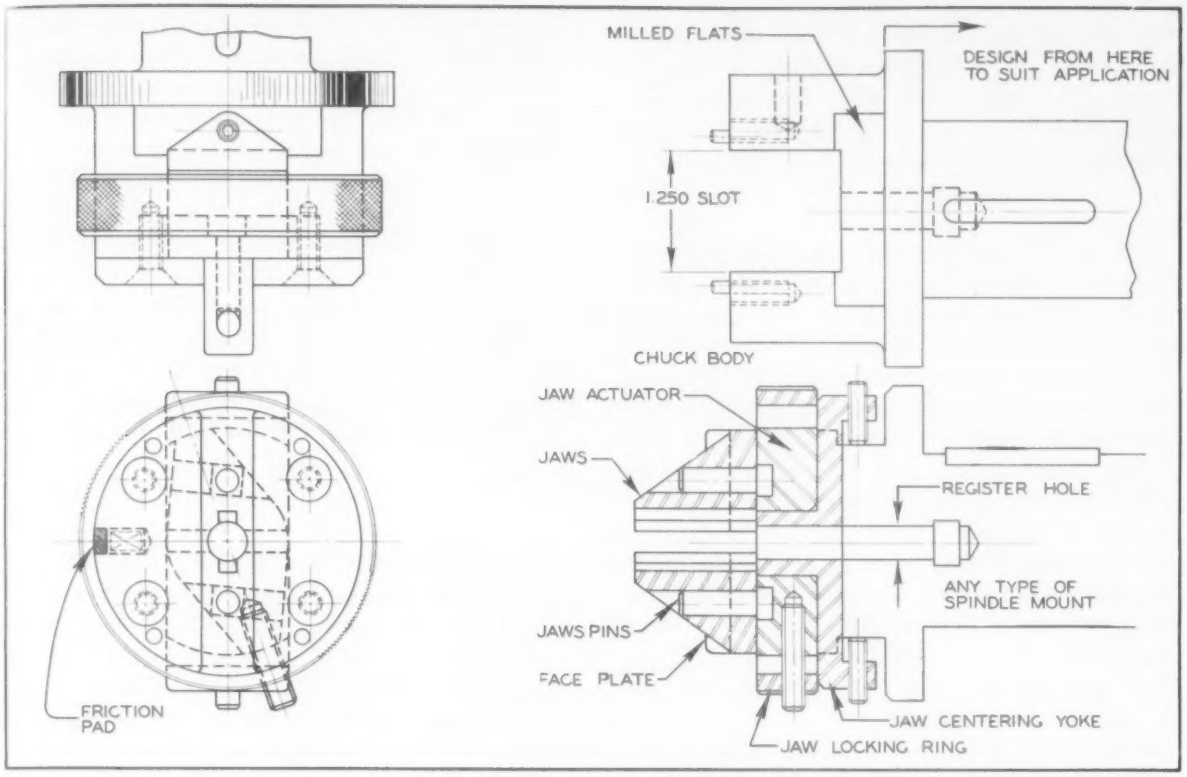
Tapping on a drill press may be made easier by reversing the spindle return spring. This results in a firm, steady pressure of the tap against the workpiece. Set the drive belt at its lowest speed, and start the tap by rotating the spindle by hand.

Once started, the power may be turned on and the tap will feed itself. When tapping blind holes, stop the drill press before the tap nears bottom and feed the last few threads by hand, as at the start.

Frank M. Butrick, Jr.
Chapter 38, ASTE

The Tool Engineer pays regular page rates for accepted contributions to these pages, with a minimum of $5.00 for each item.

On or Off Center Chuck Jaws



A chuck as suggested by the drawing, may be used for on-center or eccentric work.

The chuck here shown is designed to hold work either on center or off center. By turning the jaw locking ring, the jaw actuator is caused to rotate so that the slots in this piece force the pins outward due to their movement being restricted to up and down. Because the pins operate the jaws, the latter members move outward, thus allowing the workpiece to be admitted through the jaws. A flick of the wrist, and the lock ring closes the jaws.

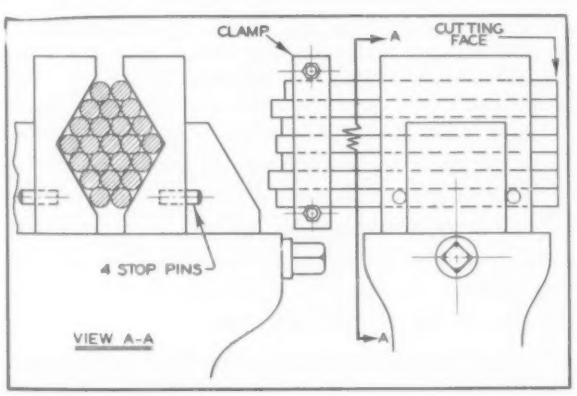
To center the jaws, insert a piece of drill rod in the register hole and clamp, then tighten the set screws in the centering ring to suit. If the part is slightly off center, or eccentric, it can be brought on center by adjusting the centering yoke, especially so if two opposed heads are used to clamp the workpiece. When the jaws are closed at the diameter of the register hole, the slots are approximately at 3 deg in relation to horizontal. Since this chuck has been proven invaluable for contour work, it should have many uses.

George Hooey
Toronto Chapter

For Multiple Cut-Off

In the Tool Engineering Handbook—page 862, "Power Hacksawing"—are shown methods of clamping round stock. For cutting in multiples, the author of the section recommended stocks nested in a bundle as shown in Fig. 54-4, the Handbook.

False V-jaws and a clamp having similar angles permits multiple cutting of round bars without particular regard to diameter of stock.



Another good way to cut round stock in multiples is to make two special V-type false jaws which are nested in the hacksaw vise and retained by four pins. A V-clamp having similar inside angles holds together the bundled rods and permits feeding without any changes in length of cut-offs.

The false jaws and clamp are not dependent on the diameters of the bars since it is only necessary to bundle as many as may be held in the jaws. For production runs, an extra clamp will permit bundling the next batch to be sawed.

L. M. Lepsöe
Member-at-Large
Bergen, Norway

Jig Making Simplified

During World War II, our toolroom was faced with producing eleven drill jigs for a quantity production item in a minimum of time. While the jigs were of simple design and hole spacings nominal—plus or minus 0.001 in.—our tooling program was crowded and our one jig borer, in particular, tied up more than all our other toolroom equipment.

This state of affairs rather precluded jig-boring the eleven bushing plates, so, we had to devise other methods of fabrication. To that end, eleven steel plates were shaped to dimensions 1½ x 13 x 23 in. Accessory components—clamps, blocks, wear plates—were machined to size, and standard drill bushings purchased. The nine holes required were then jig bored in one plate only, as indicated by A, Fig. 1. Boring the one plate did not tie up the jig borer excessively.

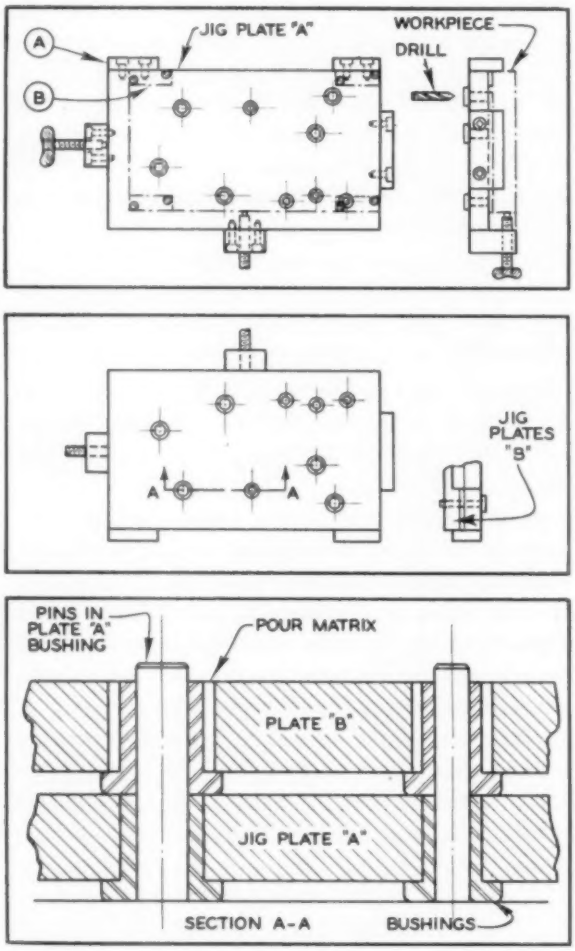
Drill bushings were pressed onto this plate in proper location, when it was used to spot drill the remaining plates. The holes thus located, the plates were drilled through with the holes about ⅛ in. larger than the body size of the bushings but less than the O.D. of the heads.

Plate A was then inverted on the bench, and pins corresponding to the bushing I.D's were inserted light press fit. Next, matching bushings were placed on the pins, head down, and plates B positioned on plate A, the holes closely centered and aligned, and the plates clamped together as indicated in Fig. 2.

A commercial low-temperature alloy was then heated to flowing consistency and poured around the bushings, as shown in Fig. 3. When the alloys cooled, the plates were separated and all were found to be superficially alike and well within the required tolerances. Needless to say, there was a great saving in machining time, especially as regards to the jig borer. In view of impending defense work, the idea seems well worth passing along.

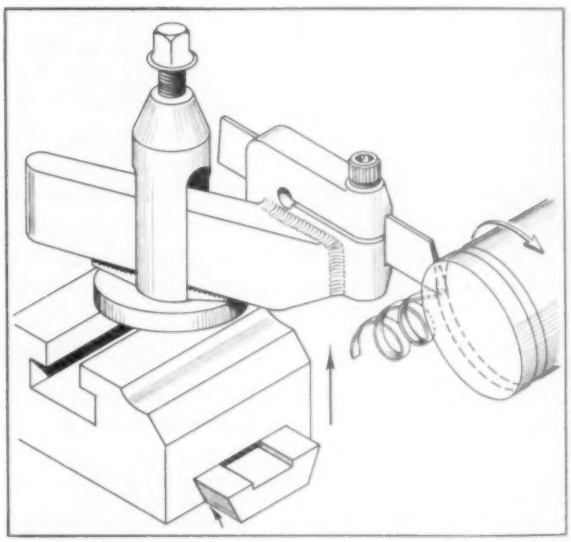
A. F. Hird
Worcester Chapter, ASTE

By jig-boring one plate of a number of identical drill jigs, then transferring the holes and locating drill bushings on the remaining plates by means of a low-melting alloy, the one plate serves as a "master" for all remaining jigs.



Chatterless Parting Tool

The lathe parting tool here illustrated is applicable where the lathe is reversible and the chucks are keyed on or where the work is held in colletts. Among its advantages are the elimination of chatter, the ease of getting coolant to the cutting edge, and reduction in tool breakage, due to elimination of the tendency to dig in and the fact that the chips can fall away from the tool instead of riding on top of the blade as with conventional parting tools.



As indicated by the arrows, the upward pull on this parting tool keeps the slides tight and so reduces chatter and extends tool life.

These advantages are obvious to anyone familiar with turret lathe tooling where parting tools are often mounted at the back of the cross-slide and cut upside-down. This type of tool has given excellent service on every kind of material used in the machine shops at Naval Air Station, Seattle, Washington, during the past two years.

Keith M. Mahler
Seattle Chapter, ASTE

Thompson Products, Inc.: Engineering Is Their Business

By Gilbert P. Muir

"BEFORE YOU HAVE anything to sell, you have engineering. Once you have a product, you have to improve it, you have to meet competition, you have to keep costs down—and that is engineering." This is a quote from Arch T. Colwell, and it helps to explain the front-row position of Thompson Products in more industries than the average company would care to think about.

Thompson's engineering goes back a long way—it is the story of a company which spent several decades gaining first a toehold, then an important position in many industries; then, like a good general, has devoted several recent years to consolidating that position. Thompson Products, one might observe, has been built on good engineering and a sensitive ear to new products. And for nearly thirty years Arch Colwell has been in the mathematical center of this campaign.

Fifty years ago the predecessor of Thompson Products—the Cleveland Cap Screw Company—was born. Sales of less than $250 in 1901 contrast markedly with the $123,000,000 which the corporation rang up in 1950. Entry of the company into the automotive parts industry was in 1904, with the development by young Charlie Thompson of the welded valve. Initially sold to the Winton automobile makers, the valve so impressed them that they bought control of Cleveland Cap Screw the following year.

Thompson's position in the automotive valve business was established when the company underwent another reorganization in 1915 which brought Thompson to the presidency. As the Steel Products Co., the firm was the leading producer of automotive valves, and achieved fame during World War I for their pioneering in aircraft valve manufacture.

Post-World War I brought three of the present management team to

The pattern behind Engineer Colwell's portrait is formed by the blades of a turbo jet axial flow compressor.

Thompson Products: Fred C. Crawford, now president; Lee M. Clegg, vice president; and Arch Colwell.

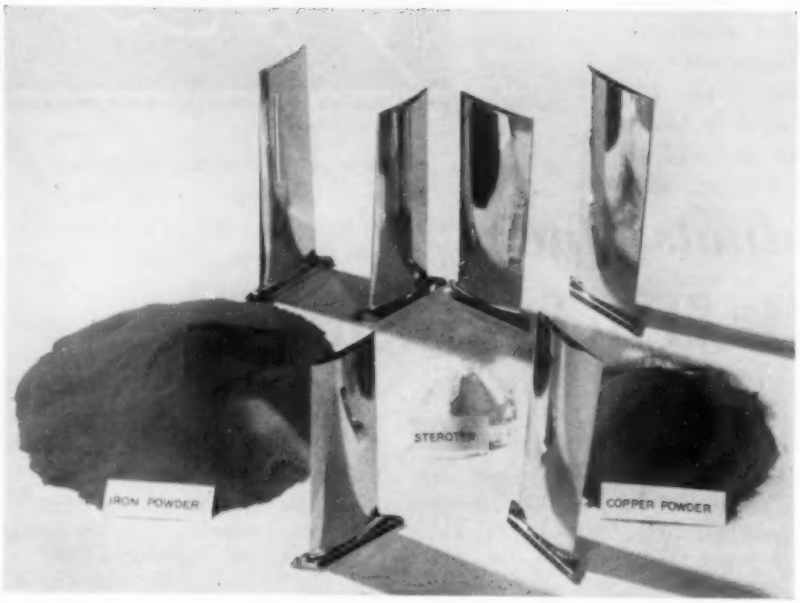
Arch Colwell divides the Thompson history into five phases: The early history just discussed; the advent of the Silcrome valve in 1921; the diversification phase from 1929 to 1941; the war period until 1947; and the reorganization phase from 1947 on. And Engineer Colwell has had the steering wheel on engineering through most of these five phases, beginning with his appointment as chief engineer in 1930.

The Silcrome valve, announced in 1929, became a big name in the automotive and aircraft fields and, with succeeding modifications in analysis, is still in heavy demand today. Later development of the sodium-cooled valve provided another important product for the aircraft industry. The valve division introduced what is now the Thompson Rotocap in 1938—a positive rotating device which assures rotation of the valve and consequently better service.

Further development engineering resulted in the U-Flex piston ring, hailed by Colwell as "the outstanding piston-ring development of the last twenty years."

The Light Metals division was established during this diversification era, adding aluminum and cast iron pistons to the Thompson line, as well as increasing line of permanent-mold cast products. Prominent among these is the steel-belted piston—a Thompson design in which the piston is controlled by a steel band around which the aluminum is cast. The belted design offers advantages in controlling rate and direction of expansion in high-speed engines operating at equally high compression ratios.

Thompson's pump division, as seen in the chart of Thompson product development, evolved its first major contribution with the booster pump for high-altitude flying. The booster



In their powder metallurgy work, the powder shown makes six blades.

design eliminated problems of vapor-locks in fuel lines at high altitudes. Continued research is underway in this division to eliminate similar and more complex difficulties inherent to jet fuel systems operating at terrifically high speeds and rates of climb.

Thompson entered the jet field in 1942, supplying hollow-bucket turbine wheels for an exhaust supercharger. In those days much of the tooling and fabrication know-how on these materials was still to be learned, and Thompson saw an opportunity to get in on the ground floor. Result: today Thompson's Tapco plant is the largest manufacturer in the world of jet components. In addition to turbine wheels, stators, compressor rotor assemblies and nozzle diaphragms, the company has pioneered in the development of the powder-metallurgy bucket blade.

Stemming from experimentation on the powdered iron blade, Thompson recently established a sixth division—Metallurgical Products—at its Tapco plant. With the experience of over 2,000,000 successful blades behind them, the division is investigating new applications for the powder metallurgy process.

Mercast—or the use of frozen mercury in place of wax in investment casting—in an activity Thompson took over in 1949. The process, using a new type of ceramic mold, gives better dimensional control of the casting, and is well-suited to the production of hollow and complicated parts. Based on the Mercast process, Thompson's Metallurgical Products division believes they have the answer to the critical materials situation by producing a hollow, air-cooled blade.

From the above description it might seem that Thompson Products—an important force in the automotive parts industry—is devoting the major part of its efforts to the aircraft end of the business. The fast-moving nature of the latter is best seen in a quote from Arch Colwell: "The automobile engine has been developed to its present state by *evolution*; the turbine engine . . . has caused a *revolution* in aircraft engines."

The Organization

Thompson Products prior to 1947 just sort of grew and expanded into a great many fields. With engineering, manufacturing and administration centralized at the top, things got to the point where it became difficult to keep an eye on the all-important small details that make a business successful.

It was then that Fred Crawford introduced the decentralized organization which Thompson proudly points to today. At the top is the corporation staff: administration, sales, engineering and industrial relations. Each of the six major activities is handled in a separate division, responsible for its individual sales, engineering and manufacturing.

Heading the staff organization is Fred C. Crawford as president, with J. D. Wright as vice president and general manager of the corporation. Lee M. Clegg heads up sales as a vice president, and Arch Colwell holds a parallel function as vice president-engineering. J. H. Coolidge is vice president-treasurer; and R. S. Livingstone, as vice president-personnel, heads industrial relations.

Staff functions effectively correlate policymaking and guidance. Engineering, for example, at staff level under Arch Colwell and Ted R. Thoren has corporation responsibility for engineering policy and new product development. Divisional engineering departments, responsible for their own activities, can use the staff organization both as a resource and a catalyst for interdepartmental coordination.

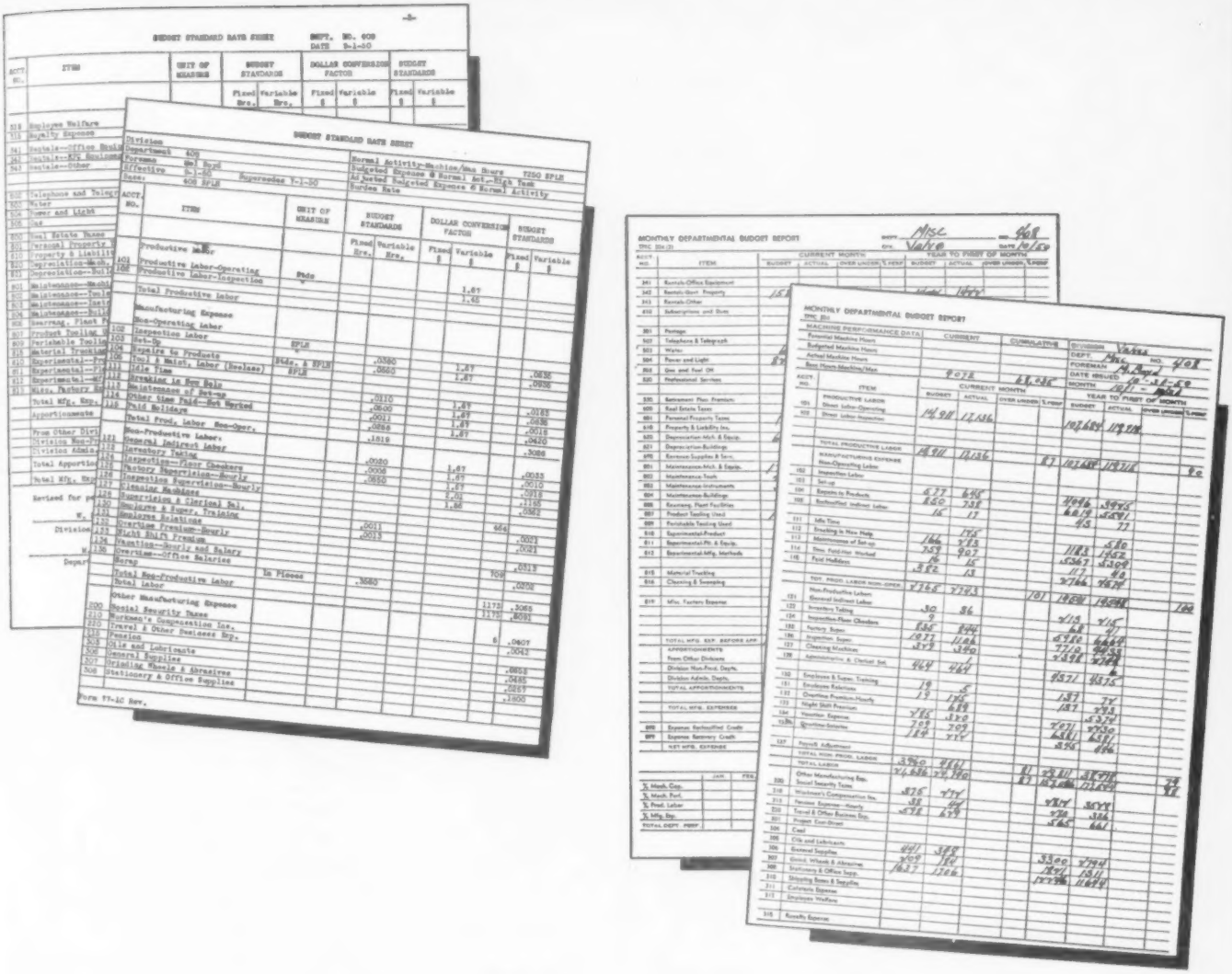
Budgets and Cost Control

A system of divisional responsibility for production and engineering is successful only to the extent that closer control of costs is available than would be the case with administration from the top. Thompson's approach to budgetary control is as precise as its machine tolerances.

Evolved by staff industrial engineering under Emil F. Gibian are a series of standards which effectively control manpower utilization, inventory and machine time, and dive to the bottom of the variable expense list.

Since labor is the biggest single element in most plants, Thompson has pioneered in the development of a job evaluation system which has

MANAGEMENT CONTROLS


BUDGET STANDARD RATE SHEET

DEPT. NO. 408
DATE 9-1-50

ACCT. NO.	ITEM	UNIT OF MEASURE	BUDGET STANDARDS Fixed Hrs.	BUDGET STANDARDS Variable Hrs.	DOLLAR CONVERSION FACTOR Fixed $	DOLLAR CONVERSION FACTOR Variable $	BUDGET STANDARDS Fixed $	BUDGET STANDARDS Variable $
513	Employee Welfare							
518	Royalty Expense							
541	Rentals--Office Equip							
542	Rentals--Mfg. Building							
543	Rentals--Other							
550	Telephone and Telegraph							
560	Water							
570	Power and Light							
574	Gas							
590	Real Estate Taxes							
591	Personal Property Taxes							
610	Property & Liability Ins.							
620	Depreciation--Mach. & Equip.							
621	Depreciation--Buildings							
801	Maintenance--Machinery							
802	Maintenance--Tools							
803	Maintenance--Instruments							
804	Maintenance--Buildings							
805	Recurring Plant Facilities							
807	Product Tooling Used							
809	Perishable Tooling Used							
815	Material Trucking							
816	Cleaning & Sweeping							
819	Misc. Factory Expense							
	Total Mfg. Exp.							
	Apportionments							
	From Other Div'ns							
	Division Non-Prod. Depts.							
	Division Admin. Depts.							
	Total Apportionments							
	Total Mfg. Expenses							

Revised for p
W.
Division
W.
Depar

Form 77-20 Rev.

BUDGET STANDARD RATE SHEET

Division
Department 408
Foreman Mr. Boyd
Effective 9-1-50 Supersedes 7-1-50
Base: 408 SPLR

Normal Activity-Machine/Man Hours — 7250 SPLR
Budgeted Expenses @ Normal Act.-High Test
Adjusted Budgeted Expenses @ Normal Activity
Burden Rate

ACCT. NO.	ITEM	UNIT OF MEASURE	BUDGET STANDARDS Fixed Hrs.	BUDGET STANDARDS Variable Hrs.	DOLLAR CONVERSION FACTOR Fixed $	DOLLAR CONVERSION FACTOR Variable $	BUDGET STANDARD Fixed $	BUDGET STANDARD Variable $
	Productive Labor:							
101	Productive Labor-Operating	Pcs				1.67		
102	Productive Labor-Inspection					1.67		
	Total Productive Labor							
	Manufacturing Expense							
	Non-Operating Labor							
103	Inspection Labor	SPLR						
104	Set-Up							
106	Tool & Maint. Labor (Enclose)	Std. Hrs. & SPLR		.0380		1.67		.0636
107	Idle Time	SPLR		.0860		1.67		.0936
108	Breakdown in Non Rela							
109	Maintenance of Set-up			.0370		1.67		.0185
116	Other Time Paid--Not Worked			.0600		1.67		.0438
110	Paid Holidays			.0021		1.67		.0016
	Total Prod. Labor Non-Oper.			.0986		1.67		.0420
	Non-Productive Labor:			.1016		1.67		.3086
121	General Indirect Labor			.0020		1.67		.0035
122	Inventory Taking			.0006		1.67		.0010
124	Inspection--Floor Checkers			.0020		1.67		.0018
125	Factory Supervision--Hourly					1.67		.0918
126	Inspection Supervision--Hourly					1.67		.1135
127	Cleaning Machines					1.80		.0562
128	Supervision & Clerical Sal.							
130	Employee & Super. Training						664	
131	Employee Relations							.0023
132	Overtime Premium--Hourly			.0011				.0021
133	Night Shift Premium			.0013				
134	Vacation--Hourly and Salary							.0313
135	Overtime--Office Salaries							
	Scrap	In Pieces					709	.0202
	Total Non-Productive Labor			.3580				
	Total Labor							
	Other Manufacturing Expenses							
200	Social Security Taxes						1173	.2069
210	Workmen's Compensation Ins.						1175	.0591
220	Travel & Other Business Exp.							
230	Pension						5	.0407
305	Oils and Lubricants							.0042
306	General Supplies							
307	Grinding Wheels & Abrasives							.0855
308	Stationery & Office Supplies							.0485
								.0857
								.1900

MONTHLY DEPARTMENTAL BUDGET REPORT

DEPT. Misc — NO. 408
Value
DATE 10/1/50

ACCT. NO.	ITEM	CURRENT MONTH BUDGET	CURRENT MONTH ACTUAL	CURRENT MONTH OVER UNDER	CURRENT MONTH % OVER	YEAR TO FIRST OF MONTH BUDGET	YEAR TO FIRST OF MONTH ACTUAL	YEAR TO FIRST OF MONTH OVER UNDER	YEAR TO FIRST OF MONTH % OVER
341	Rentals-Office Equipment								
342	Rentals-Plant Property	15							
343	Rentals-Other								
350	Subscriptions and Dues								
351	Postage								
550	Telephone & Telegraph								
560	Water								
570	Power and Light	87							
574	Gas and Fuel Oil								
580	Professional Services								
590	Retirement Plan Premium								
600	Real Estate Taxes								
601	Personal Property Taxes								
610	Property & Liability Ins.								
620	Depreciation Mach. & Equip.								
621	Depreciation-Buildings								
690	Expense Supplies & Serv.								
801	Maintenance-Mach. & Equip.								
802	Maintenance Tools								
803	Maintenance Instruments								
804	Maintenance Buildings								
805	Recurring Plant Facilities								
807	Product Tooling Used								
809	Perishable Tooling Used								
810	Experimental Product								
811	Experimental Plt. & Equip.								
812	Experimental-Mfg. Methods								
815	Material Trucking								
816	Cleaning & Sweeping								
819	Misc. Factory Expense								
	TOTAL MFG. EXP. BEFORE APP.								
	APPORTIONMENTS								
	From Other Divisions								
	Division Non-Prod. Depts.								
	Division Admin. Depts.								
	TOTAL APPORTIONMENTS								
	TOTAL MFG. EXPENSES								
890	Expense: Reimbursed Costs								
899	Expense: Salvage Credit								
	NET MFG. EXPENSE								

	JAN	FEB
% Mach. Cap.		
% Mach. Perf.		
% Prod. Labor		
% Mfg. Exp.		
% TOTAL DEPT. PERF.		

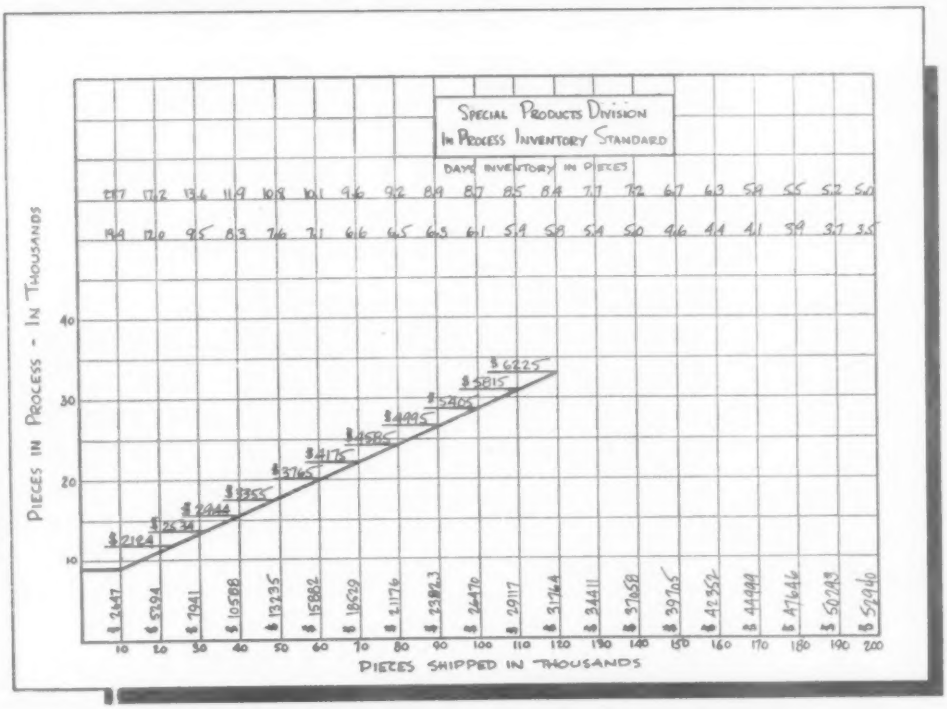
MONTHLY DEPARTMENTAL BUDGET REPORT

DEPT. Misc — NO. 408
DATE ISSUED 10/1/50
MONTH 10/1 - 10/31

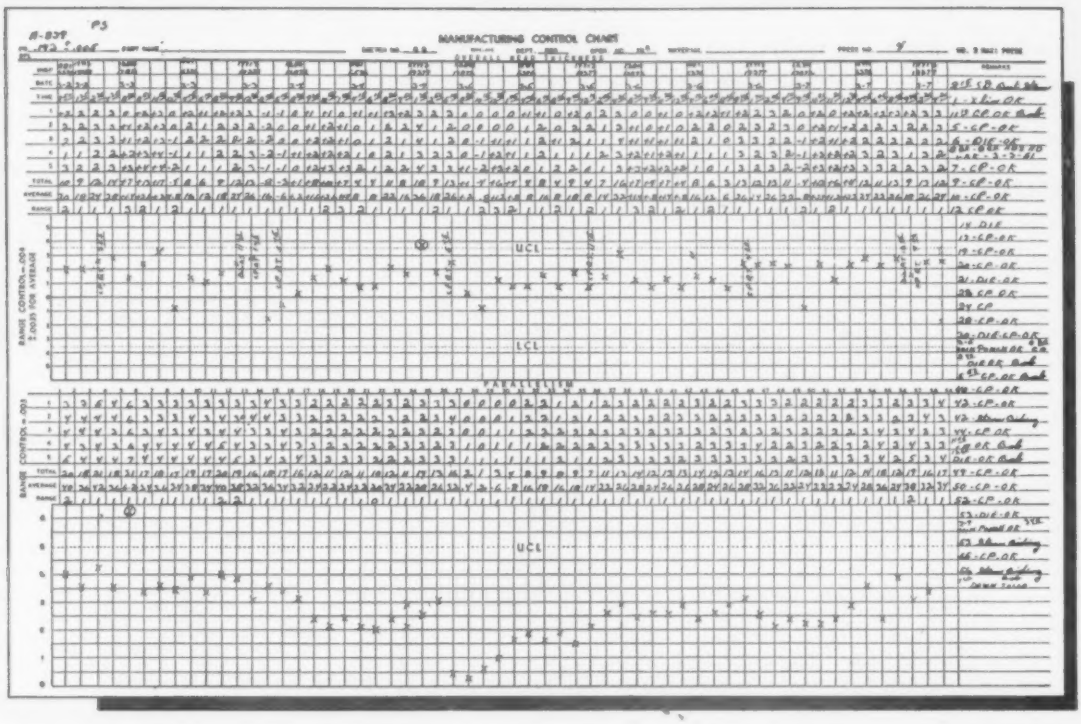
MACHINE PERFORMANCE DATA

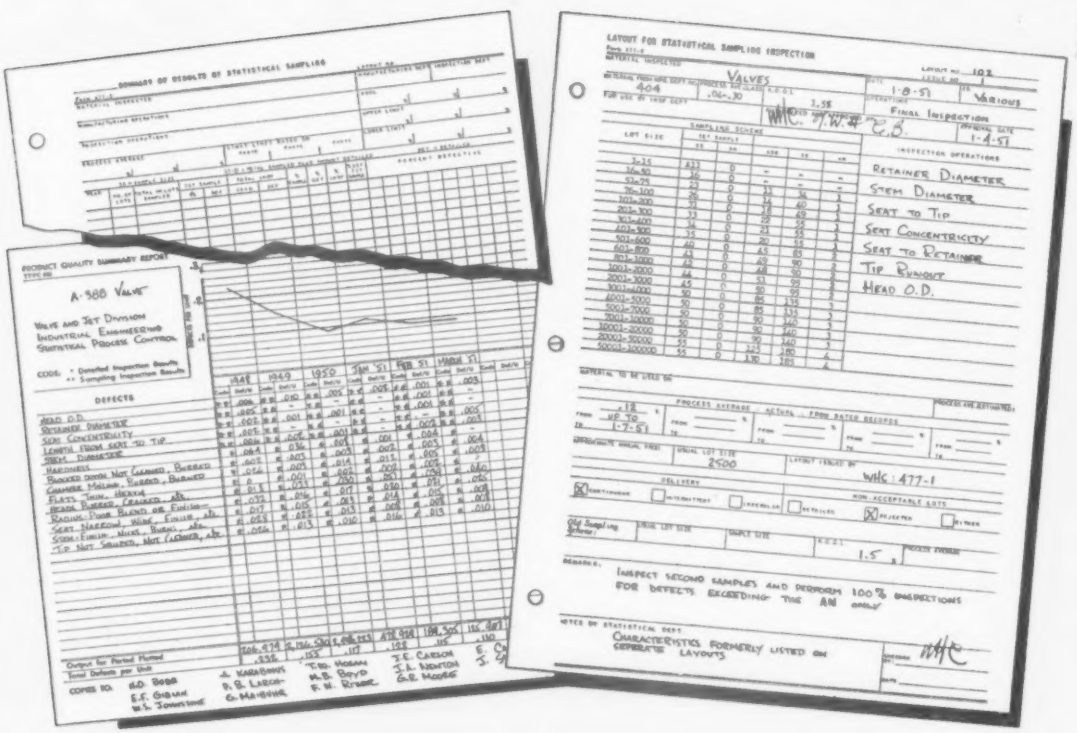
	CURRENT	CUMULATIVE
Potential Machine Hours		
Budgeted Machine Hours		
Actual Machine Hours		
Base Hours-Machine/Man	9078	83,238

ACCT. NO.	ITEM	CURRENT MONTH BUDGET	CURRENT MONTH ACTUAL	CURRENT MONTH OVER UNDER	CURRENT MONTH % OVER	YEAR TO FIRST OF MONTH BUDGET	YEAR TO FIRST OF MONTH ACTUAL	YEAR TO FIRST OF MONTH OVER UNDER	YEAR TO FIRST OF MONTH % OVER
	PRODUCTIVE LABOR								
101	Direct Labor-Operating	14,911	12,136			102,689	119,298		
102	Direct Labor-Inspection								
	TOTAL PRODUCTIVE LABOR	14,911	12,136			102,689	119,298		
	MANUFACTURING EXPENSE								
	Non-Operating Labor				87	102,689	119,298		80
103	Inspection Labor								
104	Set-up								
106	Repairs to Products	677	695			7096	3995		
107	Repairs to Machines	860	728			6819	5891		
108	Authorized Indirect Labor	16	17			95	77		
111	Idle Time								
112	Breaking in New Help		196						
113	Maintenance of Set-up	166	173				580		
114	Time Paid-Not Worked	759	907			1183	1452		
118	Paid Holidays	16	15			5267	5309		
		382	13			117	82		
	TOT. PROD. LABOR NON-OPER.	1868	2723		101	19,298	19,298		100
	Non-Productive Labor:								
121	General Indirect Labor								
122	Inventory Taking	30	86			9/15	9/15		
124	Inspection-Floor Checkers	9				48	47		
125	Factory Super.	636	644			6930	6648		
126	Inspection Super.	1073	1106			7770	8073		
127	Cleaning Machines	375	390			3858	3923		
128	Administrative & Clerical Sal.	464	467			4571	4575		
130	Employee & Super. Training								
131	Employee Relations	19	5			137	77		
132	Overtime Premium-Hourly	19	196			187	995		
133	Night Shift Premium		699				5374		
134	Vacation Expense	786	830			7071	7230		
135	Overtime-Salaries	709	709			6381	6219		
		184	314			856	894		
137	Payroll Adjustment								
	TOTAL NON-PROD. LABOR	3560	4641			29,811	33,978		97
	TOTAL LABOR	24,686	29,780		87	102,689	119,298		92
	Other Manufacturing Exp.								
200	Social Security Taxes								
210	Workmen's Compensation Ins.	875	974						
215	Pension Expense--Hourly	38	90			984	3699		
220	Travel & Other Business Exp.	498	699			978	326		
301	Power Cost-Direct					585	661		
305	Coal								
306	Oils and Lubricants								
307	General Supplies	441	348						
308	Grind. Wheels & Abrasives	209	196			3300	2794		
310	Stationery & Office Supp.	837	1206			1891	1811		
311	Operating Items & Supplies					13998	11694		
312	Cafeteria Expense								
313	Employee Welfare								
316	Royalty Expense								



QUALITY CONTROLS





THE THOMPSON LINE

FOR AUTOMOTIVE, MARINE AND INDUSTRIAL ENGINES
1906—1950

"WHEEL-A-JET" FUEL PUMPS

"MECH-A-MATIC" VALVE TAPPETS

COMPRESSION PISTON RINGS

U-FLEX OIL CONTROL PISTON RINGS

"VITAMETER" ALCOHOL-WATER INJECTORS

"ROTOVALVE" VALVE ROTATORS

"ROTOCAP" VALVE ROTATORS

SPEED-BOOSTED ALLOY FORGING

HEAVY-DUTY SODIUM-COOLED VALVES

FOR THE AUTOMOTIVE CHASSIS
1906—1950

AIRCRAFT PARTS and ASSEMBLIES
1915—1950

AIRCRAFT ACCESSORIES
1938—1950

INDUSTRIAL PRODUCTS
1945—1950

HEAVY-DUTY STELLITED VALVES

CONNECTING RODS

FROZEN MERCURY PROCESS CASTINGS

CYLINDER SLEEVES

ELECTRONIC FUEL CONTROLS

FROZEN MERCURY PROCESS CASTINGS

DRIVE SHAFT BEARING HANGERS

"XB" AND "XCR" VALVES

CO-AXIAL SWITCHES

LIGHT METAL PERMANENT MOLD AND DIE CASTINGS

CENTRIFUGAL AND MIXED FLOW BLOWERS

VALVE GUIDES

WATER-ALCOHOL PUMPS

KNEE ACTION ASSEMBLIES

JET ENGINE ROTOR COMPRESSORS

VALVE SPRINGS

VARIABLE AREA FUEL NOZZLES

GAS FIELD COMPRESSOR VALVES

SHOCK ABSORBER AND STABILIZER LINKS

JET ENGINE STATOR COMPRESSORS

VALVE SPRING SEATS

FUEL FLOW DISTRIBUTORS

ELECTRIC MOTOR END FRAMES

RUBBER BUSHINGS AND THRUMETTE

JET ENGINE TURBINE WHEELS

ENGINE BEARINGS

MID-AIR REFUELING PUMPS

WASHING MACHINE PUMPS

RUBBER-BUSHED SPRING SHACKLES

LIGHT METAL PERMANENT MOLD AND DIE CASTINGS

WATER PUMP PARTS

AFTER-BURNER PUMPS

SOFT DRINK DISPENSING MACHINE PUMPS

"SILENT-G" SPRING SHACKLES

JET ENGINE NOZZLE DIAPHRAGMS

WATER PUMPS

OIL FOAM BREAKERS

AUTOMATIC VENTING SPIGOTS

TRYON SPRING SHACKLES

TURBO-JET ENGINE BLADES AND BUCKETS

PISTON PIN BUSHINGS

FUEL TRANSFER PUMPS

ICE CUBE MACHINE PUMPS

IMPELLER-INDUCER ASSEMBLIES

CHROMIUM-PLATED PISTON PINS

FUEL SELECTOR COCKS

BALL-BEARING TIE RODS

SUPERCHARGER BLADES AND WHEELS

ALUMINUM PISTONS

"QUICK-DISCONNECT" HYDRAULIC COUPLINGS

MINING DRILL BITS

CAST IRON PISTONS

WATER INJECTION PUMPS

ECCENTRIC TIE RODS

VALVE INSERT SEATS

FUEL BOOSTER PUMPS

FORGED TIE RODS AND DRAG LINKS

SODIUM-COOLED ENGINE VALVES

VALVE RETAINER LOCKS

FUEL PUMPS

"SILCHROME" VALVES

RING SPRING TIE ROD BOLTS AND BUSHINGS

MANY DIFFERENT HARDENED AND GROUND PARTS FOR ENGINES AND AIRFRAMES

ONE-PIECE FORGED VALVES

THE THOMPSON TREE OF PRODUCT GROWTH AND DIVERSIFICATION

STARTING CRANKS AND BRAKE RODS

FORGED ENGINE VALVES—HOLLOW STEM

WELDED TIE RODS AND DRAG LINKS

FORGED ENGINE VALVES—SOLID DESIGN

WELDED VALVES

WELDED CAP SCREWS
1901

conscientiously attempted to replace guesswork with scientific analysis. This important phase is treated separately below.

Thompson's approach to cost control is a basically simple one. As summed up by Emil Gibian: "We want to plan first by standards how we should operate and then control by proper reports. Budgetary standards tell us how much each department should use of every commodity (time and machines as well as materials—Ed.) at any level of activity, and then the report tells us how they actually did perform against these budgetary amounts."

Manpower is first broken down into amount of activity in terms of standard productive hours in the various departments of each division.

The Budget Standard Rate Sheet (Fig. 1) is the foundation of divisional monthly reports, and carries a standard for every fixed and variable expense. The form is maintained on a daily basis by the departmental foreman and, in addition to fixed costs, reflects those which he can control on a daily basis.

The master sheet—or Monthly Departmental Budget Report—is the complete operating picture of the division of the month. Prepared for the division manager and the general foreman, it shows direct labor, nonproductive labor, miscellaneous general expenses, overhead, etc.—all shown in a direct comparison of actual versus budgeted figures. Since all departments within the division are included in the report—including indirect operations such as purchasing and cost accounting—the report is in effect a plan of how the division should operate.

Emil Gibian's standards occupy an important place in Thompson's production planning and control. Machine and time standards based on actual figures are one part of this activity.

Inventory control at Thompson Products is considerably more than an index to check steel shipments; it is a manufacturing philosophy which through carefully planned application had added about $4,000,000 additional working capital—money which formerly was tied up in inventories which were proved unnecessary.

Inventory Before Production

Working inventory control from Thompson's viewpoint has a relatively simple base: there must be some inventory before you can begin production. As the rate or volume of production increases, inventory must be increased to keep pace. But beyond a certain point of production volume, it is not necessary to add to inventory. Therefore the job is to determine how much inventory is necessary, control this amount, and establish simple standards for maintaining inventory at an economical level.

Control of inventory therefore begins with an analysis of available equipment in each department, adjusted to allow for setup, maintenance and other factors which cut down on actual available hours of productive time.

Value of the working process inventory is the next step—studied because of the value added to the initial item at various points during its manufacture. At this stage a protective factor of inventory is added, as well as a projection of requirements for maximum production volume of the product.

The In-Process Inventory Standards (Fig. 3) shows the projection of inventory requirements against the desired shipment of products, expressed both in total number of pieces and in dollar volume. Since the average value of the working process has been computed, this figure can be expressed in dollars of working process inventory. The average cost of sales has been established independently, and the chart therefore can be used to indicate the value of inventory which should be carried, say for next month, to maintain any particular volume of shipments.

Value of this type of production planning is well expressed by the statement made earlier that after the inventory control program was put into effect, Thompson learned that the overall value of its inventories could be lowered by some $4,000,000 without affecting efficient production.

The Engineering Function

Arch Colwell has a sound, basic approach to the relation between engineering and a successful business organization. In his three decades with Thompson Products, Engineer Colwell has played midwife to many new products, and has learned that

The Thompson team includes, from left to right, F. C. Crawford, president; J. D. Wright, vice president-general manager; T. R. Thoren, engineering manager; K. M. Bartlett, director of research, and A. L. Pomeroy, director of development.

Form 78-1 TPM

TIME STUDY SHEET

DIVISION Aircraft DEPT. No. 418 GROUP 58 DATE 4-17-51
OPER. No. 18/5 MAN No. T-4820 MACH. No. 4080 TYPE Sunstrand Lathe
F. R. No. B-553 MATERIAL T.P.A. PART NAME Aircraft Exhaust Valve

SUB. ☐ STD. ☐ Tools, Wheels, Jigs, Fixtures, Etc. Front Tool DC-1052 - Rear Tool DC-5012-18 - Snap Gage, Vantrol

Oper. Description Turn Stem and Form Nubbin

ITEM	SPEED R.P.M.	SPEED F.P.M.	FEED PER REVOLUTION	CUT DEPTH	CUT LENGTH	LIMITS
3				.239 Dia	3.375	Diam + .004 Length + .010
3	Driver	57-20-620 R.P.M.				
3	Feed	25-45	.008			

Reason for Study To Remove Estimate and Establish Standard
Former Std. Hrs. Per 100 Pcs. 1.065 M - 2.13
Observer G.B. Approved by L. J. Glaspy
FOREMAN Al Bolesic Sketch

SIZE	Hd. Dia. 1.203 Stem Dia.	
ITEM	ELEMENTS	TIME ALLOWED (Last column other side)
1.	Remove and Position Piece	.1237
2.	Advance Tool	.0210
3.	Turn and Form Nubbin	1.0320
4.	Retract Tool	.0250

Total Items	1.2017
Tool Endurance Back Tool $\frac{5.00}{224}$ = .0223	.0942
Extra Allowance Part Handling .50/55 = .0143 + 3% Misc.	.0503
Total Min. Per. Pc.	1.3462
11.1% Personal Time	.1494
Std. Min. Per Pc.	1.4956
Std. Prod. Per Hour 80.0	Std. Hrs. per 100 Pcs. 1.256
Entered Shop 4-18-51	Office 4-18-51

AVERAGE RANKINGS OF 5 JOB ANALYSTS

CODE	OCCUPATIONS	SKILL & JOB KNOWLEDGE	JOB ATTENTIVENESS	PHYSICAL EFFORT	HAZARDS	SURROUNDINGS
100	Sweeper	.58	.72	5.38	3.2	6.
130	Matron	.4	.2	2.9	1.2	2.12
151	Inside Truck Driver	1.86	2.8	4.84	3.26	3.42
171	Truck Driver	3.08	3.76	6.32	5.4	4.12
191	Oiler	3.08	2.68	3.54	3.28	2.68
201	Tool Crib Attendant	2.2	3.88	3.5	2.8	3.6
211	Millwright	3.5	5.16	7.72	6.6	6.
261	Carpenter	4.84	6.32	5.78	5.66	7.66
321	Machine Repairman -"A"	0.58	7.7	6.72	5.8	6.16
391	Tool & Gauge Inspector	8.18	9.24	7.92	9.7	6.42
401	Electrician	8.82	7.42	7.64	7.14	7.04
431	Licensed Boiler Operator	7.82	7.8	4.06	5.	5.02
441	Tool Grinder (Vb.)	4.36	6.78	4.3	3.9	4.34
472	Process Development	5.62	9.88	5.82	3.92	6.66
501	Incinerator Operator	9.36	7.6	5.26	4.58	5.7
510	Auto. Screw Machine Operator (V)	.72	6.2	5.68	4.66	5.38
1002	Auto. Screw Machine Feeder	5.62	2.82	3.88	3.4	5.2
1004	Auto. Screw Machine Operator	1.46	6.28	5.22	4.06	5.26
1012	Turret Lathe (302)	4.7	4.46	5.32	3.7	5.2
1014	Turret Lathe (V)	4.12	3.4	5.16	4.2	4.68
1016	Turret Lathe (Pointing) (V)	2.28	4.66	4.26	4.68	5.1
1116	Milling Machine (303)	4.7	6.4	5.46	4.58	5.08
1132	Engine Lathe (J)	5.52	6.96	5.46	4.58	5.08
1242	Engine Lathe (426)	6.34	4.7	5.12	4.4	5.06
1246	Bullard Operator (J)	3.42	4.12	5.24	4.08	5.06
1332	Centerless Grinder	3.84	4.36	4.46	4.06	5.12
2012	End of Stem Grinder	2.46	6.16	4.4	4.14	5.06
2041	Internal Grinder (306)	4.3	4.5	3.54	3.9	5.04
2102	Surface Grinder	4.82	3.78	5.24	4.2	5.26
2142	Bench Girls (J&P)	2.	4.	5.68	4.14	5.32
3002	Pollen Blades	2.38	4.22	3.3	2.3	3.24
3221	Hand Torch Tip	2.66	4.3	6.04	6.44	9.2
4099	Press Operator, Tocco-Manual Feed	5.28	3.3	5.36	5.68	9.6
4051	Tester - Forge Shop	2.24	3.02	6.2	7.04	2.38
4301	Drop Hammer	5.78	5.76	6.2	7.94	2.38
5222	Floor Inspector	4.6	5.	2.04	2.56	4.35
5502	Indicate (V)	4.5	3.46	4.56	3.7	3.4
5505	Jig Bore Operator	8.28	8.64	7.5	6.2	5.14
5607	Mill - Toolroom	9.8	8.02	6.28	4.18	4.46
6111	Toolmaker	9.56	9.66	6.78	4.58	8.28
6172	Hot Cut-off	3.18	3.46	5.64	3.72	5.9
7012	Degreaser (311)	.86	1.2	3.46	2.2	2.6
7021	Sodium Filler	1.1	4.22	4.96	4.9	4.7
7041	Roll Straighten	2.88	3.76	4.2	2.04	2.9
7131	Compressor Assembly	3.48	3.58	4.2	2.2	7.7
7160	Permanent Holder (Rapid Pistons)	3.78	3.12	5.64	3.66	6.98
9212	Sand & Vapor Blast	1.34	1.96	3.32	3.66	2.36
9340	Order Picker	.52	2.18	3.96	1.4	2.38
8601	Conveyor Pack (Service Division)	.66	1.4	3.04	1.2	2.38
8660	Wrap Valves					

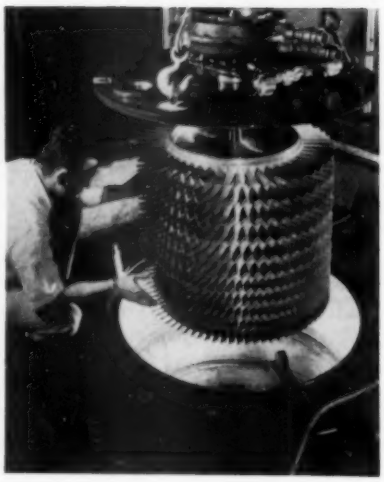
AVERAGE RANKINGS OF 5 JOB ANALYSTS
(AFTER REVISION BY UNION & SUPERVISORS)

	SKILL & JOB KNOWLEDGE	JOB ATTENTIVENESS	PHYSICAL EFFORT	HAZARDS	SURROUNDINGS
	.5	.5	5.5	4.	6.
	.5	.5	2.	2.	4.
	2.	4.	5.	4.	4.
	3.	4.	6.5	6.	4.
	3.	3.	3.5	4.	6.
	3.5	4.	3.5	2.	2.
	5.	5.	7.5	6.	6.
	6.5	6.5	6.	6.	6.
	8.	7.5	6.5	6.	6.
	9.	9.	2.	2.	2.
	8.	7.5	5.	10.	4.
	4.5	4.	4.5	4.	4.
	5.5	4.	4.	4.	6.
	10.	10.	4.	4.	4.
	.5	1.	6.	4.	6.
	5.5	6.	5.5	4.	6.
	4.	4.5	5.5	4.	6.
	2.5	3.5	5.	4.	6.
	5.5	6.	5.5	4.	6.
	5.5	6.5	5.5	4.	6.
	6.5	7.	5.5	4.	6.
	5.5	4.5	5.	4.	6.
	4.	4.	5.	4.	6.
	2.5	3.5	4.5	4.	6.
	6.	6.	4.5	4.	6.
	5.	4.5	3.5	4.	6.
	2.	4.	3.	2.	4.
	2.5	4.	3.	4.	6.
	2.5	3.	3.5	4.	6.
	6.	5.	6.	8.	10.
	2.5	4.	6.	8.	10.
	6.5	6.	6.5	8.	10.
	4.5	5.	2.5	2.	2.
	1.5	3.5	4.5	2.	4.
	8.5	8.5	3.8	4.	6.
	8.	8.	4.5	4.	6.
	0.5	0.5	2.	4.	6.
	3.	3.5	3.	6.	8.
	1.	1.5	2.5	4.	6.
	3.	4.	6.	8.	8.
	3.	3.	5.	4.	4.
	3.5	4.	4.5	4.	2.
	4.	4.5	6.5	8.	8.
	1.	2.	5.5	4.	6.
	3.5	4.	3.5	2.	2.
	1.	2.	3.5	2.	2.
	.5	1.5	3.	2.	2.

TRIAL EVALUATION No. 2

	(50%) 250 SKILL & JOB KNOWLEDGE	(25%) 125 JOB ATTENTIVENESS	(15%) 75 PHYSICAL EFFORT	(5%) 25 HAZARDS	(5%) 25 SURROUNDINGS
	13	6	42	10	25
	25	6	25	5	10
	50	50	38	10	10
	75	50	49	15	10
	75	38	26	10	15
	88	50	26	5	5
	125	63	45	15	15
	163	88	56	15	15
	200	94	69	15	10
	225	113	13	5	5
	200	75	38	20	10
	113	50	29	10	10
	138	88	30	10	15
	250	125	32	10	10
	13	13	45	10	15
	138	75	41	10	15
	38	38	41	10	15
	138	75	30	10	15
	100	50	41	10	15
	63	44	38	10	15
	113	56	34	10	15
	138	81	41	10	15
	163	88	41	10	15
	138	88	41	10	15
	100	50	38	10	15
	63	44	38	20	15
	150	75	34	10	15
	125	56	26	10	15
	50	50	38	10	15
	63	50	41	10	10
	63	63	26	10	10
	150	69	45	20	25
	63	50	41	20	25
	163	75	49	20	25
	38	63	19	5	5
	213	106	38	5	10
	200	100	26	10	10
	250	119	34	10	15
	75	44	38	10	10
	25	19	53	15	20
	75	75	41	10	15
	88	38	199	20	5
	88	50	38	10	10
	100	56	34	10	5
	25	25	49	20	20
	88	50	45	10	15
	75	88	26	5	5
	13	19	22	5	5

9212	Sand & Vapor Blast
8601	Order Picker
8603	Conveyor Pack (Service Division)
8660	Wrap Valves



Compressor rotor is lowered into spin pit for high speed test.

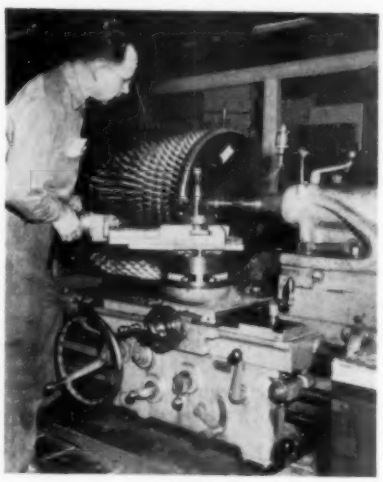
careful attention throughout the life of the product is virtually as important as the birth itself. He explains it thus: "No one product stands still; if it does, it will eventually die. It may have patent protection but it will certainly die with the patent protection. The development (necessary to meet competition) may lead into research and new avenues of manufacture which lower costs and improve the product. In doing those things you probably diversify, and large business has grown by additions to product after product until they became big business through diversification. And that was through engineering."

An original idea for a new product, says Colwell, is about five percent of the total development effort, regardless of how worthwhile the idea may be. The big 95 percent lies in further product design refinement, laboratory testing followed by field tests, tools, machines and personnel required—and working capital.

Since development and research are necessarily important Thompson activities, a considerable amount of work is concentrated on these twin functions. Focal point of coordination here is Ted R. Thoren, engineering manager at staff level. Rising through the development end of Thompson's engineering division, Ted Thoren has a clear-cut concept of the coordination required to bring a new product to the production stage. Completing the team are Ken M. Bartlett, director of research; and A. L. Pomeroy, director of development.

Arch Colwell has named three sources of inception of a new product: submission of an idea by an inventor or designer, either within or outside the company; development of a product at the request of a customer; or sensing the market need for a new or improved product, and proceeding to develop it.

The Vitameter, recently placed in limited distribution by Thompson Products, provides a typical case history of the development pattern of a new product. The Vitameter is an

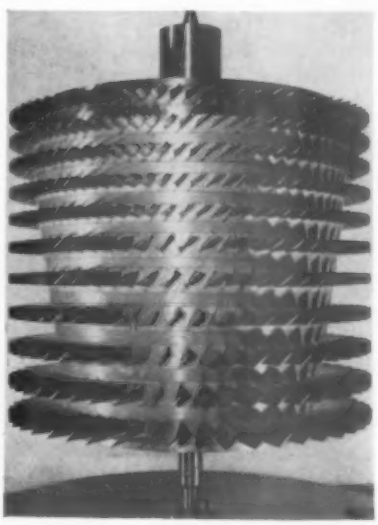


Finish turning operation is done on axial flow compressor rotor. Operator does finish turning on axial flow compressor rotor.

alcohol-water injector which, working through the carburetor of an automobile, in effect raises the octane rating of the gasoline some six to fifteen points. Allowing for differences between individual products, its development pattern ran somewhat as follows:

1. Original inception of the idea. In this case the Vitameter was originated outside the company.
2. Initial study by a project group under the director of development.
3. Study and decision by an engineering panel composed of the vice president-engineering, engineering manager and director of development.
4. Assigned to a project group to evolve a satisfactory testing design. In this case the original Vitameter design was a brass casting. Several hundred units were completed and assigned for testing in actual use. Field tests indicated that the product functioned as claimed, so
5. Decision was made to go into production. Market studies had been paralleling development work, and from this a tentative selling price had been established. In relation to the selling price, the manufacturing cost was too high, therefore
6. The brass design was again studied for possible design changes. A die casting was studied, and tests were run first on zinc to determine its suitability. It was found that aluminum provided better corrosion resistance, so a workable prototype was evolved and assigned again to field tests for 9 to 12 months.
7. The aluminum model showed satisfactory test results, and meanwhile chemical research provided an inhibitor which permitted use of a steel tank to store the supply of fluid for the Vitameter.
8. The product was released for

Finished rotor is ready for installation.



manufacture and tooling was set up for the aluminum die-cast model.

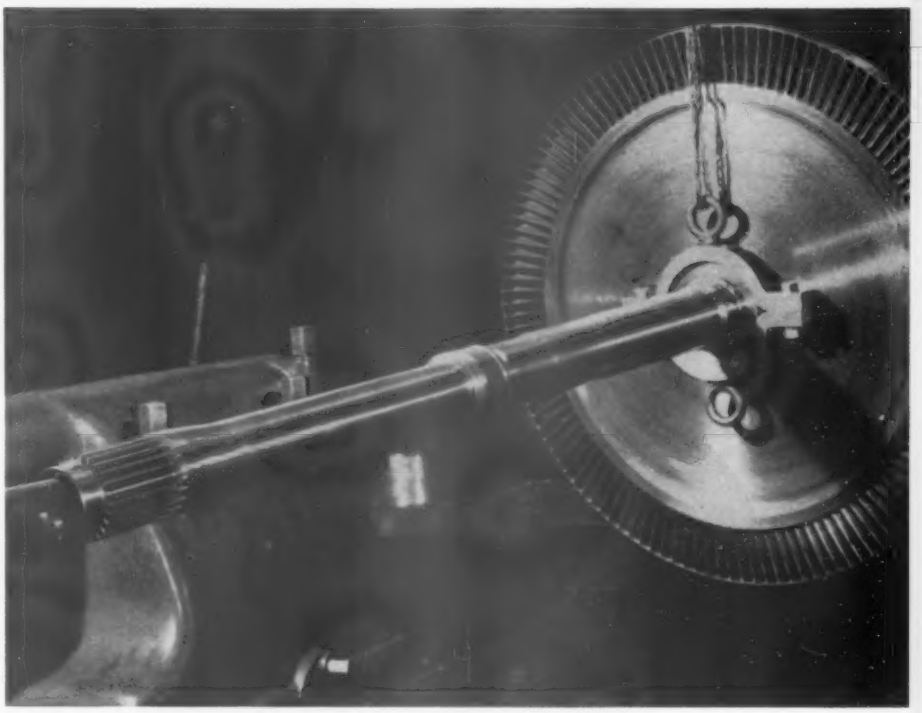
Statistical applications at Thompson Products represent an activity of widespread effect. In addition to being the foundation of Thompson's quality control procedure, it forms a basis, as we shall see later, of job evaluation and performance standards in the company.

Statistics has been compared by Thompson to radar, which can see through fog and reveal the significant facts concerning a situation. Emil Gibian cites as an example a request some time ago for a special allowance of $25,000 to overhaul ten turret lathes because they were not capable of holding the turrets which were necessary on a particular job. Analyzing the machines with the aid of process and control charts, a statistical engineer found that the machines were in good enough shape to hold the turrets if the process were properly controlled statistically. Control charts were installed, and the job has been running satisfactorily for some four years. Result: a saving of $25,000 with the investment of about $200 of the engineer's time.

Quality control at Thompson Products is a responsibility resting with the engineering, rather than the production division. Thompson men feel that it is a logical assignment of responsibility which makes for more effective specification and control of manufacturing standards.

A quick picture of Thompson's quality control program can be seen in Figs. 4 to 7. Here are the basic forms used to watch machine performance and evaluate quality levels of the product both in process and in periodic review. Fig. 4, from the valve division, is an operations chart controlling production on the press. As seen from the chart, plottings are made periodically to insure product tolerances within the assigned limits. Plottings above or below tolerance limits indicate need for investigation.

Statistical sampling on the valve line at Thompson is accomplished with the aid of the Dodge-Romig 1.5 percent A. O. Q. L. chart shown in Fig. 5. The form indicates type of operation to be carried out, source of material, sampling table, an approximation of the output, usual lot size, disposition of non-acceptable lots and the latest process average per cent defective for the characteristic to be inspected.



Thompson's jet engine turbine wheel and shaft assembly.

Supervisory and management review of product quality are aided by the forms shown in Fig. 6 and 7. The Summary of Results of Statistical Sampling, prepared for the chief inspector and the quality control engineer, provide detailed analyses weekly of the effectiveness of the sampling plan. The Product Quality Summary Report is furnished monthly to shop supervision, engineering and management, and keeps them posted on current quality levels.

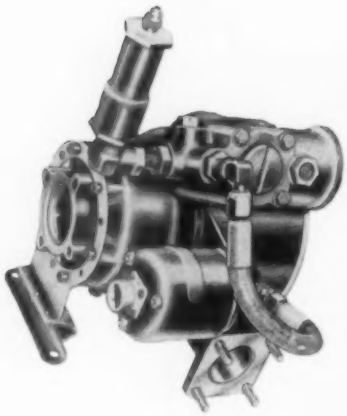
Engineering for Output

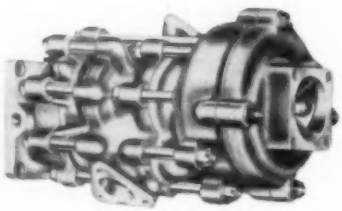
There are two related functions of engineering at Thompson Products which in many respects are unique in their development and application. Thought of as a team, they are worker performance ratings and job evaluation.

Establishing a standard for a job and then attempting to evaluate a worker's performance in relation to that standard is a job which is difficult, to say the least. There is no need to go into the inaccuracies generally involved in the process, or the confusion which these inaccuracies have caused.

Thompson's basic belief is that a given job should be rated at 100 percent worker efficiency, and the worker's performance in turn rated against the 100 percent ideal performance. This belief is based on the argument that it is more logical to determine the maximum output of a particular operation and measure output against that, than it is to attempt to set a "normal" pace to be maintained or bettered.

How do you set a maximum rating that will hold? Thompson relies on a two-part system which first time studies the operation as accurately as present methods will permit, and then evaluates the operating efficiency of the worker being timed, as well as other workers on the same operation.





Some of the important Thompson products include (left, top to bottom) water-alcohol injection pump for jet-powered aircraft; shallow-tank fuel booster pump; high-pressure fuel pump, "re-engineered" for more fuel at higher pressures; and (below) co-axial switch for electronics. Below, left, three-dimensional models are used for plant layout studies.

Methods Time Measurement forms an important part of the Thompson approach; using standard data the timing of an operation actually involves methods engineering to the extent that in setting up the motion sequence on an operation, Thompson men are able to eliminate waste motion.

The physical time study is augmented by good forms (Fig. 8) and continuous, intensive blackboard-and-movie sessions in the industrial engineering department.

Since the operating efficiency of the worker being studied must be determined to arrive at a maximum-output figure for the operation, the relative-efficiency figure is crucial.

Thompson therefore set out to train its time study men to determine the performance rating of an operator against the maximum output figure which had been established for the operation. It was felt that to do an effective job the time study must be within 10 percent, plus or minus, of the correct rating, and further that 70 percent of the studies must be within plus or minus five percent of that figure.

Thorough initial training was required to bring the engineers to a level where individual estimates of a given job would not vary more than five percent. Many were within two and one-half percent of that ideal line.

In concluding, it is interesting to note that Thompson's engineers felt, when setting up the plan, that a worker efficiency of 83 percent of the maximum rating would be the norm. Actually the average, through control of materials flow, good methods study, etc., runs 90 percent or better.

Job Evaluation

The job evaluation program at Thompson Products has been an attempt to introduce engineering methods into a much-maligned and misunderstood phase of manufacturing.

The aim of Thompson's study was to determine what each job in the organization is worth in relation to other jobs in the organization. As has been pointed out, wage formulas which evolve without prior planning can cause considerable dissatisfaction when an employee learns that another worker is receiving more money than he, for a job which he considers comparable to his own. Too often management is hard put to justify the differential with an explanation which is factual enough to satisfy the worker. Thompson feels that the employer must be in a position to present facts and figures to prove that existing wage rates bear the correct relationship to each other. Neither can management afford to have high-salaried personnel spend considerable time in rate negotiations when a new occupation is started or when a change in an occupation takes place.

Three types of job evaluation plans were studied: the ranking method, the weighted point method and the factor comparison method. In developing a plan which would eliminate most of the current disadvantages, Thompson engineers decided on a program which would combine the best points of all three

After further study, it was decided that the following factors were to be considered in evaluating a given job:

Skill and Job Knowledge: This appraises the difficulty of a job, manual dexterity involved, tolerances involved, and the ability necessary to perform the occupation. Independent thinking required is also to be considered.

Job Attentiveness: Degree of attentiveness required to proficiently apply skill and job knowledge. Consider difference between presence of mind or reflex and apparent thinking or reasoning required for the job.

Physical Effort: Degree of muscular effort and continuity of same. Also considered is the position in which employee is required to work: amount of stooping, walking, lifting, etc.

Surroundings: Overall surroundings of the work station, including presence of smoke, heat, cold, noise, vibration, grease, coolant splash, etc.

Weighting these factors in the final analysis is of major importance. Since the factors are not of equal importance in establishing a ranking, Thompson engineers evolved a weighting system which began by assigning trial rankings to key jobs in the plant. The development of ratings was as follows:

1. Ranking the key jobs by each factor from one to ten. (No regard to weightings at this time.)
2. Assignment of a trial weighting for each factor.
3. Conversion of ranking to evaluated points on the basis of trial weighting.
4. Plotting of the evaluations against present base rates.
5. Determining the amount of average deviation between actual base rates and evaluated base rates derived from the trial weighting.
6. Continuing the above process until the lowest possible average deviation is determined.

Next, of course, was the selection of "key jobs" in the plant. Five guides were used in the determination of these occupations:

1. They must be jobs which are generally accepted as being correctly rated first as to the absolute rate, and second, as compared with each other.
2. The jobs should be distributed over the entire wage structure from high to low.
3. They must represent a good distribution of the various job characteristics from high to low in each characteristic.
4. They must present a good cross-section of all types of occupations in the company.
5. They should be well-known, stable jobs with which all concerned in the development of the plan are familiar.

Thus forty-nine key jobs were selected as a basis for study. Next five analysists, working independently, assigned points from zero to ten for each of the factors in each job. The five rankings of each factor in the key jobs were then averaged, and the result was the initial ranking shown in Fig. 9.

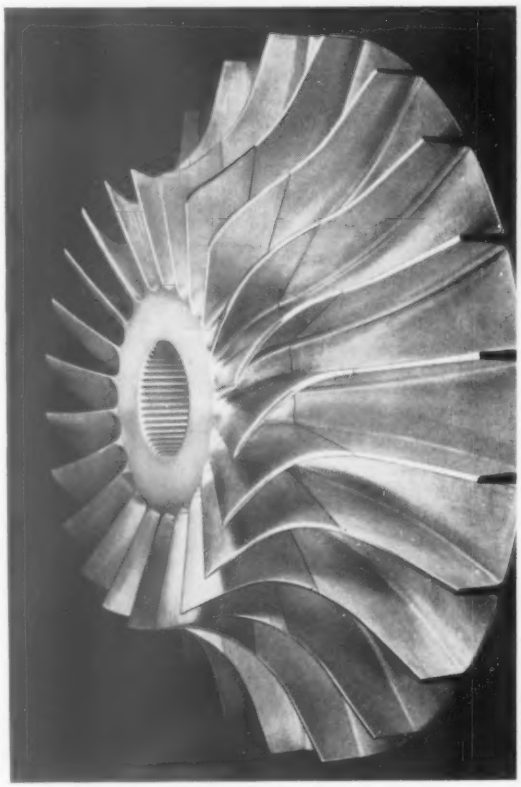
When the assigned rankings were converted to points using the shown set of weightings, it was discovered that on a number of jobs differences in ratings were so slight as to cause possible confusion and misunderstanding. Therefore the first three factors (skill and job knowledge, attentiveness and physical effort) were rounded off to the nearest half or whole number. It was felt that plant conditions and the type of work done were such that it would be difficult to rate hazards and surroundings closer than a ranking of two. After consultation with union representatives and members of the supervisory force, the rankings shown in Fig. 10 were accepted for further study.

Thompson believed it fundamental that the current wage structure of any company is the place to begin any adjustment of wage structure. Therefore, since the 49 key jobs were in part selected because they were believed to carry a fair wage rate, it followed that a projection of point ratings into the company's current wage scale should show little deviation.

The ratings shown in Fig. 10 were subjected to a series of trial evaluations, followed by graphic plotting against current wage standards, until a final set of ratings was obtained as shown in Fig. 11. The final deviation here was 0.0254 cents per hour. The final rankings in Fig. 11 are expressed in relative number of points of a 500-point maximum, assigned as indicated at the top of the chart.

How has the plan worked? Thompson engineers agree that it has eliminated most if not all of the former misunderstandings about occupations and wage rates, because the basis for rating a specific job is logical and consequently not open to the type of dispute common to wage programs where rates are arbitrarily assigned. Thompson further believes that at least part of the reason for failure where similar plans have been attempted lies in too much influence by prevailing community wage patterns, and setting up the system without bringing a worker-management team into the picture at the beginning.

Thompson's inducer-impeller assembly for aircraft.



Ordnance Challenges T. E.'s To Lick Arms Production Problems

Industry Charges Expediting Bottleneck, Is Promised Help, in Mobilization Forum; ASTE '52 Show Space Filling Up; Survey Shows Heavy, Tool Modernizing Programs

What They Said About Tool Engineers

Your technical skill and know-how will help us forge the weapons to make the nation militarily strong . . . to fulfill the inevitable demand for civilian goods once we have satisfied our military needs.

Charles E. Wilson
Director of Defense Mobilization

To be charged with replacing men with machines, buying time with machines, and extending the nation's materials with machines, is second only in importance to carrying the fight to the enemy.

Lt. Gen. Kenneth B. Wolfe
U.S. Air Force

Attainment of professional recognition in industry is our objective. You are the fellows who must decide whether we do this job or toss it aside; whether we try for the goal that is afar or just be content to stay where we are.

Jacob J. Demuth
1951-52 President, ASTE

We are at the crossroads. One way leads to higher standards of living; the other way leads back to where we were a hundred years ago. We know which road we choose, but the signposts are not too clearly legible. To choose the right goal, we will have to use our ability to think things out.

Herbert L. Tigges
1950-51 President, ASTE

In proportion to their numbers, tool engineers have contributed more to the attainment of objectives in the Constitution of the United States "to provide for the common defense" and "to promote the general welfare" than any other segment of the population.

Richard F. V. Stanton
American Machine & Foundry Co.

CAN YOU DESIGN special purpose tools and machines to produce 160,000 rugged, electronic relays monthly with only 100 of the 600 assembly line workers now theoretically required on such an order? Is there a faster, more efficient method of precision tooling for airframe assembly?

Can a simple, inexpensive way be found to tool up for high production of jet engine blades? What available die material can be cast to shape, takes good surface finish, requires no die cutting nor polishing and can withstand high compression loads under heated conditions?

These are some of the million-dollar questions that the U.S. Air Force wants tool engineers to answer.

Can We Get Cooperation?

What help are we going to have in getting materials and machines to build these things? Can we change material specifications to get more production?

Why is management expected to finance expanding facilities in manpower and inventory with no provision for capitalization? Are standard sized parts available, interchangeable with similar ones made in Canada and Great Britain? How do we go about getting critical personnel deferred from armed service?

Those were a few of the posers that ASTE members shot back to ordnance men. The volleys of questions were exchanged at the Mobilization Technical Know-How Conference that opened the Society's 19th annual meeting in New York, March 14-17.

"During wartime the Air Force cannot tolerate the use of men and women on an operation when it can be performed by a machine; nor can the tool engineer," Lt. Gen. K. B. Wolfe, deputy chief of staff for materiel, asserted as

Top: R. A. Winblad (right) of Cincinnati Milling Machine Co. discusses a slide from his lecture, with C. O. Herb of "Machinery," session chairman. Bottom: Another technical chairman, L. F. Gay (left) of Westinghouse Electric Corp. presents certificate of appreciation to Charles Aldino of Sperry Gyroscope Co., for his talk on gears.

Lt. Gen. K. B. Wolfe tells a questioner at mobilization know-how forum how to cut red tape in getting equipment for defense production. At left is Capt. C. L. Helber, the Navy's representative at conference.

he bared vexing problems faced in developing air strength.

His listeners were the vanguard of some 1200 tool engineers gathering from all over the United States, from Canada, Europe, and other parts of the free world. They represented shipbuilders, automotive firms, government installations working on new weapons, makers of aircraft and accessories, railway equippers, dental suppliers, universities, research organizations, manufacturers of agricultural and industrial machinery, optical goods, timepieces, cutlery, household appliances—even cribs and cradles.

To Stamp One-Piece Plane Wings

Two heavy German presses being installed at Adrian, Mich., will be capable of stamping out airplane wings in one piece, the speaker revealed. Other press projects and tooling studies running into millions were detailed by General Wolfe.

Extreme accuracy is required in building and servicing today's fast aircraft. Maximum performance is demanded. But materials, time and manpower are short. It's up to the tool engineer to cope with these conditions on varying production bases. While he touched only on airframes, engines and electronics, the applications range from the largest bomber to the smallest jewel bearing, the General added.

Other Services Need Help

The same goes for the Army and Navy, according to Col. J. S. Walker, deputy district chief of the New York Army Ordnance District, and Capt. C. L. Helber, representative of the Bureau of Aeronautics at the New York Naval Shipyard. They want bombs and torpedoes that will not be duds, tanks and flattops that can take what the enemy dishes out.

As the audience asked for solutions to bottlenecks plaguing them, they got immediate, direct and definite answers. Sometimes from the military officers, sometimes from ASTE President H. L. Tigges, machine tool consultant to NPA, or from Vice-President R. F. Waindle, who moderated the forum. Both the military and the engineers left the forum with a mutual respect for and understanding of each other's problems.

Preparatory to tackling their assign-

Top, left: President J. J. Demuth in inaugural address asserts that tool engineers will pave the way for nation's greatest weapon—production. Right: H. L. Tigges, board chairman, calls recess at directors' meeting. From left, standing: E. W. Ernst, L. B. Bellamy, J. P. Crosby, F. W. Schmitt, B. J. Hazewinkel, H. E. Conrad, G. A. Goodwin, V. H. Ericson, R. B. Douglas, W. A. Thomas and T. J. Donovan, Jr. Seated: R. F. Waindle, J. J. Demuth, Mr. Tigges, H. E. Collins and A. D. Lewis. Bottom, left: Banquet speaker R. F. V. Stanton (left), American Machine & Foundry Co. vice-president, talks shop with President Tigges. Right: Early arrivals give the registration desk a brisk workout. Registration represented cross-section of defense and civilian manufacturing.

From top: William Jarvis of Hartford, chairman at tapping torque talk by A. J. Carruthers of Greenfield Tap & Die Corp., checks program for location of session. G. H. Grossnickle of Westinghouse Electric Corp. brings a question to A. C. Sanford of Federal Products Corp. At right is session chairman, J. B. Gosselin of Bulova Watch Co. Participants in an afternoon program get together at luncheon. From left, standing: C. B. Carlson, Thomas A. Edison, Inc.; E. M. Hicks, Norton Co.; Arnold Pfenninger, Jr., Connecticut Hard Rubber Co.; D. A. Vance, Korfund Co.; T. P. Orchard, Airborne Accessories Corp.; A. Melnick and W. P. Powers, U.S. Tool Co.; T. C. Barber, national program committee. Seated: Adolf Bregman, consulting engineer; J. L. Petz, Petz Co.; H. M. Goldman, Enthone, Inc.; H. D. Hall, Hall Foundation, and A. J. Schmitt, Permanent Mold Corp.

Left: Two speakers and their chairmen chat while waiting for their sessions to open. From left: J. L. Webster, Eclipse-Pioneer Div., Harry Pelphrey, Michigan Tool Co., W. A. Stadtler, International Business Machines Corp., and I. W. Hutchison, Jr., Dow Corning Corp. A. L. Gardner (left) and B. H. Marks of Pangborn Corp. emphasize points in talk on liquid impact blasting.

Gardner Young (seated, right), program vice-chairman, has breakfast conference with a group of speakers and chairmen. From left: E. F. Galvin, Galvin Tool Sales Corp.; F. W. Boulger, Battelle Memorial Institute; S. D. Brootzkoos, General Services Administration, and William Schoen, Columbia Metal Box Co.

ment, ASTE'ers buckled down to acquiring the latest techniques in 32 engineering subjects. The 28-session technical program was the largest ever sponsored by the Society.

Although there were as many as five meetings running concurrently, most were heavily attended. As each speaker finished, one or two experts in the respective field read commentaries on his talk. Their suggestions for other applications, for clarification or enlargement of specific points gave the listeners additional slants.

A paper-covered volume of the original papers, plus the written discussions, is available from ASTE headquarters for $2.50 per copy. The Society's first published proceedings of national meetings, it is the beginning of a technical library unobtainable from any other single source. An order blank appears on another page in this section.

Exhibitors Book for '52 Show

More than 100 reservations have been made for space at the 1952 Tool Engineers Industrial Exposition in Chicago, March 17-21. H. E. Conrad, executive secretary, made this announcement at the annual meeting of the board of directors. The reservations followed distribution of an analysis of attendance and buying at the 1950 show in Philadelphia. A survey of the outlook in the machine and tool business has just been completed. Plans for the Chicago show and convention at the International Amphitheater and the Stockyards Inn are well under way, Mr. Conrad added.

"The tool engineer—the man with the production know-how" is now the official ASTE slogan. It was adopted by the board on the recommendation of W. G. Ehrhardt, **public relations** chairman.

Plants Are Going Modern

As part of the committee's report, A. F. Denham, public relations counsel, showed the directors slides made from the study of machine and tool buying trends. For all industries combined the tool engineer specialist has 36 percent of the responsibility for recommending changes in processing and equipment and for selecting the type and make. At the beginning of the year 80 percent of the plants studied had a program for continuous modernization or were initiating one.

At the chapter level Mr. Ehrhardt's committee will write a monthly news letter publicizing promotional ideas used by chapters. And the voices of national officers, directors and committee chairmen will come to local ASTE executives in a seven-minute recording explaining public relations procedure.

Handbook Reprinted Sectionally

The first sectional printings of the "Tool Engineers Handbook" are off the press, E. W. Ernst, **book** chairman, reported. One, comprising sections 104-110 and 113, is titled "Practical Design of Mechanical Elements" and priced at $3.00. The second, "Basic Machining Operations," embraces sections 28-42. Another, headed "Practical Design of Manufacturing Tools, Dies and Fixtures," includes sections 96-100. The latter two each sell for $2.75. They are available in bookstores

or from McGraw-Hill Book Co., 330 W. 42nd St., New York City 18.

Chairman Ernst appealed to chapters and to individual members for material to be considered for inclusion in the "Handbook of Metal-Stamping Dies" now in preparation.

Will Recognize Contributors

Chapter headings will credit major contributors and the respective reviewers. Other individuals and organizations contributing will receive recognition in the preface. Frank W. Wilson, book editor, will write the manuscript. Reviewers appointed from the membership will check it.

In future the committee to nominate candidates for directors will have 18 months to work on its assignment. R. B. Douglas of Montreal, chairman of the incumbent committee, felt that the few weeks intervening between its appointment and the deadline for preparing a slate was inadequate to make a careful selection of nominees and to obtain acceptances. To inaugurate the new system, the board voted to retain the present committee until the next semi-annual meeting.

On a motion by Fred J. Schmitt of Chicago the directors incorporated in the by-laws a provision for a special **nominating committee** to submit a slate of candidates for each national office. Its report must be in the hands of each director at least 30 days prior to the annual meeting election.

Membership Boosted 506

Society **membership** is definitely on the rise. H. B. Osborn, Jr., chairman of this department, cited an increase of 506 over the past year. Chapters have been chartered at Dover, N. H., Jackson, Mich., and Garden City, L. I., and new groups are forming in several other cities. With tool engineers in increasing demand, the future looks bright for continued growth, Mr. Osborn believes.

Now being readied for American Standards Association approval, the first ASTE-sponsored standard will cover the classification and identification of tool steels, L. B. Bellamy, **standards** chairman, announced. A subcommittee of the B52 project on classification of materials for tools, fixtures and gages is working on this, under the direction of G. A. Roberts of Vanadium Alloys Steel Co.

New Committees Named

Other sub-committees, set up to handle the accelerated B52 activity are: B52.2—Manufacturing Size Limitations, D. I. Dilworth, Jr., Crucible Steel Co., chairman; B52.3—Material Heat Treatment, L. A. Tyner, Ford Motor Co., chairman; B52.4—Performance and Physical Qualities, A. S. Jameson, International Harvester Co., chairman; and B52.5—Machinability, L. B. Bellamy, Sterling Grinding Wheel Co., chairman.

Additional appointments to the parent B52 committee include L. A. Wacker, Sterling Tool Mfg. Co., and H. W. Robb, General Electric Co., as representatives of the National Tool and Die Mfrs. Association and the American Society of Mechanical Engineers, respectively.

George Roberts has succeeded D. J. Giles of Latrobe Electric Steel Co. as chairman of the Coordinating Committee.

W. H. Smila, **honor awards** chairman, told how his committee had worked out two types of awards. One classifi-

W. A. Tyson, Windsor chapter delegate, is first man to register at 19th annual meeting.

Top: Society officers and military men tell the press about tool engineer's importance in armament production. From left: Capt. C. L. Helber, President Tigges, Col. J. S. Walker, Vice-President Waindle, C. O. Herb of "Machinery" and George Elwers, "Iron Age." Bottom: National committee chairmen congratulate H. B. Osborn, Jr., membership head, on increase of more than 500 members. From left, standing: D. R. Linch, constitution and by-laws; R. I. Robbins, professional engineering; A. M. Sargent, research; R. H. Morris, honor awards committeeman; A. R. Diamond, education committeeman. Seated: W. G. Ehrhardt, public relations; G. S. Wilcox, Jr., standards committeeman, Mr. Osborn, and J. N. Edmondson, education. Board heard reports of all chairmen.

Below: G. J. Scranton (right) of Ford Motor Co. discusses his paper on quality control with W. E. Wheaton, session chairman.

Led by Ernest J. Hills, the Union Twist Drill Co. Employees' Glee Club delights banquet audience with famed rendition of the "Whiffenpoof" song.

cation is for achievement or outstanding merit through contributions to technical knowledge and human progress in tool engineering. The other, to be made on behalf of a donor, is for outstanding technical literature.

Persons wishing to commemorate the life of a member may establish income producing endowments for this purpose.

The awards may take the form of a life or honorary membership in the Society, a medal or trophy, cash, a testimonial or certificate.

Urges Registering as Professional

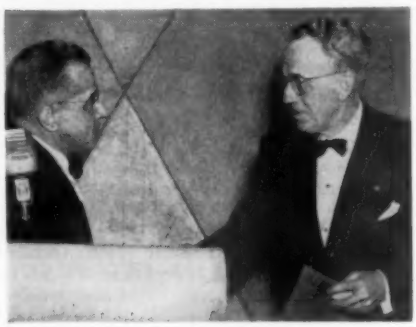
In some chapters, up to 45 percent of the members are registered professional engineers, a survey, conducted by Ralph I. Robbins and his Committee on **Professional Engineering,** revealed. But overall registration is much lower.

Every tool engineer who possibly can is urged to register as a "professional engineer," not under any specific section, unless it is a requirement for registration. In pioneering this move among engineering societies, ASTE recognizes that a professional engineering group is the best common meeting place.

To give an idea of typical questions used in refresher examinations, the committee is preparing a sample study course.

Publishes By-Law Amendments

D. R. Linch, **constitution and by-laws** chairman, wants national officers and committeemen to review procedures applying to their functions and suggest ways of simplifying the Society's oporations manual. His committee has distributed to chapter officers revised copies of the constitution and by-laws containing by-law amendments passed by recent boards. Proposed constitutional amendments are now before the membership for referendum vote.



On his retirement from office, H. L. Tigges (right), outgoing president, receives Society life membership from J. J. Demuth, his successor.

Reader and advertiser reaction to physical changes and new editorial features in *The Tool Engineer* have been generally favorable, according to the report of W. F. Sherman, **editorial** chairman. The committee and the magazine staff will continue their study of publishing operations, while the business manager is undertaking the development of promotional material.

Need Better T. E. Training

In an effort to help industry obtain trained personnel, manufacturing executives will be urged to seek expansion of college tool engineering courses and curricula leading to a bachelor degree in this profession. The directors approved the recommendation of J. N. Edmondson, **education** chairman, that chapter chairmen write local industrialists to this effect. Professor Edmondson and his committee are now developing four- and five-year curricula.

G. A. Rogers, **program** chairman, quoted the addition of 40 lecturers to the Society's speakers directory.

Detroit will have the first area meeting to be nationally sponsored since the discontinuance of semi-annual conventions. It is scheduled for early fall, with another tentatively planned for next spring in a midwest city.

The directors reappointed A. M. Sargent chairman of the **Research Fund Committee,** pending approval of the research project in the current membership voting on constitutional amendments.

President Tigges presided as board chairman, assisted by J. J. Demuth, H. E. Collins, and R. F. Waindle, vice-presidents.

F. J. Schmitt, V. H. Ericson, and B. J. Hazewinkel served as tellers in the election of officers (in June issue).

The president swears in Greater New York chapter officers. From left: J. P. Schneider, chairman; Edward Galvin, first vice-chairman; Mr. Tigges, Virginia Martino, secretary, and John Dokulil, treasurer. Hugo Aglietti, second vice-chairman, was not present for ceremony.

More than 600 ASTE'ers and guests crowd the New Yorker's ballroom for the banquet and national membership meeting.

MR. TIGGES also welcomed chapter representatives to the **house of delegates** meeting, conducted the election of a chairman, and installed Carl Kertesz, host chapter chairman, in this office.

Howard Gross of Philadelphia was named recorder, with T. C. Barber of Chicago, G. C. Wood, Pittsburgh, and W. W. Gilbert, Waterloo Area, as Credentials Committee. J. B. Savits of Boston was elected delegate-at-large.

E. W. Thorp of Mid-Hudson, C. M. Smillie, Detroit, and A. J. Schmidt of Northern New Jersey were tellers in the election of directors (announced in the June issue).

Asks More Time to Pick Nominees

The house asked the board to change the by-laws to permit election of chapter nominating committees in November. This action would allow more time in preparing for February officer elections.

DESPITE THE HEAVY technical session program, 459 members squeezed out time to visit local manufacturers offering **plant tours.**

Close tolerance die casting in the magnesium foundry was studied by the party visiting Eclipse-Pioneer Div. of Bendix Aviation Corp. Other high points included the screw machine section of the plant and methods used in fabricating flexible metal hose.

See Matrix Production

At Mergenthaler Linotype Co. the men crowded around automatic and semi-automatic operations for producing brass matrices, the grooving and opening of channels in magazine plates, and other precision jobs in building linotype machines.

Harry DeJur, vice-president of DeJur Amsco Corp., welcomed the ASTE'ers to his plant and explained machining techniques employed.

As the party proceeded through the manufacturing departments they saw camera case castings being profiled by two's on a converted Bridgeport miller, and camera claws being ground in four positions with one wheel setting, while held on an indexing block. Exacting tests conducted on the finished products impressed the group.

How conveyors and material handling equipment have reduced the cost of assembling the hundreds of parts making up television receiver sets was demonstrated at the Allen B. Du Mont Laboratories assembly plant. Members of this tour commented on the efficient plant layout.

Other companies who guided parties through their plants included American Machine & Foundry Co., Curtiss-Wright Corp., Wright Aeronautical Corp., and Ford Motor Co.

Former presidents escort their wives to banquet. From left: A. M. Sargent, F. A. Shuler, J. R. Weaver, W. H. Smila, W. A. Wagner.

LADIES ATTENDING the convention had their own program of activities. Women members of the host chapter and wives of committeemen kept the out-of-towners busy with sightseeing, radio and TV studio trips, department store "plant tours" and luncheons. They took them to art exhibits, the U.N. General Assembly, a planetarium show—even on a sail—to the Statue of Liberty.

IT WAS STANDING ROOM only at the annual **banquet and membership meeting.** Late comers were disappointed to find that the Hotel New Yorker ballroom was sold out to its capacity of 600.

Wilson Wires Thanks

The dinner opened on a patriotic note as President Tigges read a telegram from Charles E. Wilson, director of defense mobilization, thanking the Society for its resolution to support the rearmament effort.

As we start another defense program, the same costly errors made in World War II are being repeated, R. F. V. Stanton, executive vice-president of American Machine & Foundry Co.,

These tool engineers are off to visit one of the metropolitan industries. Tours were booked to capacity plants could handle.

warned in his address, "Discipline of Accuracy."

As developers of the systems, processes and tools that established the foundation of American mass production, Mr. Stanton appealed to tool engineers to institute reforms in national evils.

Paraphrasing General Sherman's Civil War prediction, he said, "No nation of so-called harmless agrarian reformers can lick a nation of experts in mass production, provided that the latter are not betrayed by some of their own citizens."

It's time for our leaders to exercise the close tolerance in the spending hand that they exact with the collecting hand, he charged. Government should follow the same procedure the tool engineer does in producing the best product at lowest cost, the industrialist contended.

President Tigges installed the new national officers and those of the New York chapter. He passed along to J. J. Demuth, his successor, the president pin and the president's honorary membership in the Institute of Production Engineers, Great Britain.

The newly installed president presented a life membership to Mr. Tigges. From his fellow officers and directors he received a pocket watch as a token of esteem and appreciation.

An honorary membership was bestowed on Senator Ralph E. Flanders. In his acceptance the senator reminisced about his visits to chapters in early Society days.

Glee Club Outshines Floor Show

The Union Twist Drill Co. Employees Glee Club stole the show from the professional entertainers. Encored insistently, they obliged with a repeat concert at the close of the banquet program.

ONLY OTHER SOCIAL event was the annual luncheon of former presidents. The retiring incumbent became a member of the alumni when W. H. Smila, chairman of the group, presented a past president's pin to Mr. Tigges. Also attending the affair were: T. B. Carpenter, F. A. Shuler, W. F. Wagner, J. R. Weaver, A. H. d'Arcambal, F. W. Curtis, O. W. Winter, R. H. Morris, A. M. Sargent, I. F. Holland and R. B. Douglas.

RADIO AND TV fans heard about the importance of tool engineers in the national economy. President Tigges spoke into one network, Vice-President Waindle broadcast on a news roundup, while Past President Douglas was the highlight of Luncheon at Sardi's.

In a press room, run by A. F. Denham, public relations counsel, newspaper and trade journal representatives interviewed officers and program personalities.

AFTER THE LAST technical session Saturday morning, ASTE shut up shop at the New Yorker and went home. All but a party of 37 who boarded the *Queen of Bermuda* for a post-convention

Top: Women tool engineers of the host chapter take a stab at Harry Marble's "Hits and Misses." From left: Virginia Martino, chapter secretary; Idalyn Cohen, publicity chairman; Broadcaster Marble and Florence Daniels of the reception committee. Center: Out-of-town ASTE'ers get hearty welcome at the Eclipse-Pioneer plant. Bottom: House of delegates considers nominees for directors. In right foreground is Howard Gross of Philadelphia, house recorder.

cruise. Often rough through the Gulf Stream, the sea was smooth on both in and outbound trips.

Following the feverish convention pace, everybody settled down for some luxurious lazing, interspersed with shipboard games, and entertainment.

Ship Puts on Plant Tour

But a tool engineer on a holiday never misses an opportunity for a plant tour. They climbed up and down ladders, through air locks, inspected the pressurized engine room of the turbo-electric powered vessel. They saw mass production in the kitchens, the bakery, the laundry, and a print shop no bigger than a roomy closet.

Climax of the tour was the point where indicators for each set of engines visually record changes in conditions, to permit correction.

In two days ashore it was hard to decide how to apportion time to sightseeing, shopping for foreign goods, and enjoying the Princess Hotel's resort facilities.

Rubbernecking from Midget Cars

Grouping by three's, most of the party crammed themselves into little Austins with driver guides. They walked down into the Crystal Caves over a pontoon bridge, and up to the top of Gibbs Hill Lighthouse. Pink coral houses, white shutters, blue morning glories, fragrant Easter lilies, a blue-green-amethyst sea. Just what the travel ads said.

Some peered at odd looking fish and noisy tropical birds at the aquarium, or pulled up sharks and turtles at Devil's Hole. Others watched a pilot perfume plant extracting exotic scents from solidified oils impregnated with constantly renewed fresh blossoms.

But everybody sighed with regret that it all had to end.

In the party were: Mr. and Mrs. C. G. Adams, Minneapolis; Mr. and Mrs. G. H. Allen, Kalamazoo; Miss Margery Cooper, Montreal; Mr. and Mrs. Victor Diggins and Mr. and Mrs. D. McKenzie, Port Credit, Ont.; Mr. and Mrs. Clinton Haig, J. B. Savits, Mr. and Mrs. W. B. Wells, Mr. and Mrs. N. S. Sweetland and Mrs. B. C. Hill, all of Boston.

Mr. and Mrs. H. R. Hanson, Mr. and Mrs. Louis Small, Mr. and Mrs. A. M. Sargent, and J. S. Eacock, all of Detroit; Mr. and Mrs. A. D. Lewis and Miss Joan Lewis, all of Los Angeles; Edward Mann, Philadelphia; H. F. Ramsdell, Worcester; Mr. and Mrs. William Reiff, Jr., Cleveland; Roy Ring, Toronto; Mr. and Mrs. C. E. Seely, Rochester, N.Y., Mr. and Mrs. W. C. Swain, Concord, N.H., and Winner Delp.

From top: Eagerly anticipating their post-convention holiday are some of the 37 who sailed to Bermuda. From left, on companionway: J. B. Savits, Boston; A. M. Sargent, Detroit; C. E. Seely, Rochester; and William Reiff of Cleveland. On deck: W. C. Swain, Concord, N.H.; Mrs. Seely, Mrs. Sargent, Mrs. Swain, Mrs. Reiff and Mr. and Mrs. H. R. Hanson, Detroit.

A. D. Lewis, Los Angeles director, whiles away time at sea showing Roy Ring of Toronto his golf form. Russ Segus (center), junior engineer of the "Queen", explains how pressurized atmosphere reduces variation in speed of Diesels, recorded on indicators. Around him from left: Victor Diggins, Port Credit, Ont.; Roy Ring and J. B. Savits.

Right: Society past presidents get together for annual luncheon. From left, standing: I. F. Holland, J. R. Weaver, A. H. d'Arcambal, R. H. Morris, H. L. Tigges (initiate), F. W. Curtis and A. M. Sargent. Seated: T. B. Carpenter, W. A. Wagner, W. H. Smila and F. A. Shuler.

Long Island Chapter Chartered With 215 Members

Garden City, N. Y.—The chartering of 163 new members at Garden City, Long Island, lent an auspicious note to the opening of the Society's annual meeting in New York. In addition 52 ASTE'ers, residing on Long Island and formerly affiliated with Greater New York chapter, transferred to the group in their vicinity. The chartering took place March 12 at the Garden City Hotel.

Harry E. Conrad, national executive secretary, presided and conducted the election of officers. The report of Sheldon Meyers, nominating chairman was unanimously accepted by the membership.

Maehl Elected Chairman

Henry Maehl, manager of production engineering, Ranger Aircraft Engines, Farmingdale, was elected chairman, along with William W. Rogers, head of the Mechanical Technical Department, Long Island Agricultural and Technical Institute, Farmingdale, as first vice-chairman; Hugo Aglietti, secretary and treasurer, Taag Designs, Inc., Brooklyn, second vice-chairman; George C. Bennett, process engineer, Sperry Gyroscope Co., Great Neck, secretary, and Arthur Cervenka, assistant chief tool engineer, Grumman Aircraft Engineering Corp., Bethpage, treasurer.

Joseph C. Brenner, works engineering manager of Sperry Gyroscope Co. and one of the chapter organizers, was named delegate to the national meeting.

H. E. Collins, director-elect from Houston, Texas, read the installation service to the officers. Chairman Maehl received the chapter charter and the chairman's emblem from Thomas C. Bradford, national membership committeeman from Worcester, Mass.

Meyers Receives Service Award

As his first official act the new chairman presented the service award pin to Sheldon Meyers. Mr. Meyers, who is owner of Production Consultation Service, Massapequa, was instrumental in the organization of the chapter.

Firsthand observations of conditions in Europe from a tool engineer's viewpoint were brought to the group by Mr. Collins. In his capacity of chief production engineer, Hughes Tool Co., Houston, Mr. Collins recently made an extended stay abroad, including trips to Iron Curtain countries.

Visitors at the meeting included Leslie F. Hawes, national membership committeeman from Los Angeles; Frank W. Wilson, book editor, and John S. Eacock, assistant to executive secretary, both of ASTE national headquarters at Detroit.

In addition to the officers the following are charter members of the new chapter: Anthony J. Angerami, Charles L. Benesh, Edwin A. Bitowski, Harry Bosshard, Carl K. Brinke, Auguste P. Cornet, Jerome F. Danneo, John F. Fitzwilliam, Bruno J. Foglio, George J. Grasso, Arthur H. Hechchel, John H. Hoehman, Fred J. Kaden, John J. Koberlein, William Lingner, Alan V. Long, Arthur Mansfield, Gerald P. Marski, Henry P. McDermott.

* * *

Henry O. Muller, Alfred C. Pennisi, Frank J. Peragine, George J. Reffelt, Howard R. Sewell, James B. Smith, Raymond L. Smith, William A. Somerville, John H. Thalmann, Emil Trojan, Robert D. Woodcock, Albert Anderson, Jr., Emilio Andreola, Leo M. Blatnicky, Patrick F. Caden, Frank J. Caruso, Pierre Chantemerle, Carl E. Classon, Carl Dingelstedt.

William R. Gress, John Hamberger, Percy C. Hobbins, Stanley Mihanowich, Stanley J. Pace, Ewald Pitell, William O. Ponath, Albert B. Ramsperger, Lester K. Rogacki, John J. Ryan, William L. Salivar, Conrad H. Samish, Daniel Szczepanski, Anthony J. Triano, Charles J. Turek, William P. Werner and Walter J. Jackowski, all of Sperry Gyroscope Co., Great Neck.

* * *

Robert J. Ashton, Carl F. Christensen, Edward Deallenbach, William L. Ellis, Frank J. Hahn, John W. Halada, Eric A. Hamilton, Edgar W. Hill, Harry G. Kilthau, Louis S. Kutkiewicz, Edward H. Leszak, Wilfred H. Marty, Harry R. Miner, Andrew P. Muller, Carl G. Nelson, Gerard A. Paquin.

* * *

Henry Regelmann, David R. Schnaars, Otto Tesch, William E. Thomas, Richard Van Harken, Jules A. Vishney, J. Ralph Walker, Edward F. White, Fred H. Beck, Robert C. Bonniwell, Albert F. Bosch, Robert F. Bostock, Elwood D. Bryant, Edward L. Davies, Jules Erbacher, Charles Gerber, Thomas A. McGowan.

Harvey D. Notov, William T. Oberle, John J. Wiegand, Arthur J. Edstrom, William G. Griffiths and Joseph H. Stern, Fairchild Engine Div., Farmingdale.

* * *

Jerome Barfus, John J. Barnes, Arthur E. Baxter, William Bean, Emil Becker, Jr., John Bierschenk, Jr., Eric H. Bjork, Harry Brooklyn, Frank E. Campbell, George V. Cave, Charles F. Coffill, Robert Conrad, Steven Doktor, John M. Ehrenfeld, Robert H. Geignetter, Henry C. Grau, John C. Hatter, Gilbert R. Herdt, Van Wyck Hewlett, Frank H. Huether, Benjamin C. Kirkup, Fred S. Kramer.

Adolph L. Duca, Richard D. Mase, George J. McLaughlin, Joseph J. Mele, Edward L. Meslin, John M. Miller, Robert J. Mills, Herbert R. Murphy, Gustav V. Nyberg, Rudolph C. Osterholm, William J. Peterson, Harold H. Poett, Robert J. Sanderson, E. C.

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Chapter listings include member as well as meeting news.

Left: T. C. Bradford (left), national membership committeeman, wishes Long Island chapter success as he hands charter to Henry Maehl, chairman. Right: H. E. Collins, Houston director-elect swears in: Chairman Maehl, W. W. Rogers, first vice-chairman; Hugo Aglietti, second vice-chairman; G. C. Bennett, secretary; Arthur Cervenka, treasurer, Joseph Brenner, delegate. Last man unidentified.

Schaarschmidt, Hiram S. Shlimbaum, Henry O. Sjoman, Matthew Skarzynski.

Charles N. Tacke, John Teufel, Jr., William D. Tuttle, Robert A. Wagenseil, William J. Gibney, Augustus R. Agneta, Louis Bender, Jr., Arnold W. Brodbeck, Byron L. Brown, Donald W. Brown, John Campbell, Willard A. Cornwall, Robert F. Dunlop, Henry L. Fazzari, Ben Jankowski, Sara T. Moxley.

* * *

Charles Pellegrini, Charles F. Coffill, A. D. Donno, John J. Dudonis, William Engerisser, Robert J. Mechanik, William J. Noonan, Raymond H. Ross, Donald E. Whitehurst and Emanuel A. Zajic, Grumman Aircraft Engineering Corp., Bethpage.

Nathaniel Skidmore, Henry F. Rodalewicz, Joseph E. Hoffman, Julius C. Hertsch, Wesley E. Pye and Philip A. Straub, Republic Aviation Corp., Farmingdale.

Bert C. L. Kolff, Eric Preece and William A. Schilk, Ranger Aircraft Engines, Farmingdale; Reynold H. Astrove, Glen Oaks; Frederick Herzner, Glendale; Joseph Austin, Hygrade Products Co., Long Island City; Ben Berk, Ben Berk Co., West Hempstead; Frederic H. Betke, Mold Fellows, Maspeth.

* * *

Robert J. Betz and George Muller, armed service; Harold W. Billard, Western Electric Co., and Joseph G. Brady, Pratt & Whitney, both of New York City; Robert T. Goffin and Robert H. Luhman, Stratos Corp., and John H. Hayes, Island Machine Co., all of Farmingdale.

George C. Hrabak, Brookhaven Laboratory, Upton; Alfred Kelsen and Theodore Scherer, P. Sorenson Mfg. Co., Woodside; Harry E. Marlett, Colgate Mfg. Co., Lindenhurst; Hugo Mueller, Simplex Tool & Die Co., New Hyde Park; Rosario Rizzo, consulting engineer, Elmont; Abraham B. Rosenberg, Federal Machine & Tool Co.

Anthony Santana, New York Naval Shipyard, Brooklyn; Herman Schmucker, Aerocraft, Inc., Bayshore; Robert W. Smith, Long Island Agricultural and Technical Institute; Joseph P. Toolan, Mergenthaler Linotype Co., Brooklyn.

Ralph L. Bazley, Kollsman Instrument Co., Elmhurst; Frank J. Bogaert, S. S. White Dental Mfg. Co., Prince Bay; Harry J. Boll, American Machine & Foundry Co., Brooklyn; Edward D. Northrop, Apex Tool & Cutter Co., Shelton, Conn.; Jonathan Pratt, John Hassall, Inc., Brooklyn.

Max Stein, Renwal Mfg. Co., Inc., Mineola; Chester W. Bock, Bock Mfg. Co., Farmingdale; Alan Carver and Robert J. Patrick, Standard Tool Co., and Peter P. Jordan, American Time Products Co., all of New York City; Oscar Nelson and Sydney Weissman, Nelson Bros. Metal Ornaments, Inc., Brooklyn.

Joseph Shrenshock, and Alois Stauber, Daco Machine & Tool Co., Brooklyn; Edward A. Heiner, Edward A. Heiner Co., Farmingdale; Joseph V. Kielb, Seeger Refrigerator Co., Glendale, and W. M. Stocker, Jr., McGraw-Hill Publishing Co., New York City.

What Would You Give

To know the latest practice and opinion pro and con on 32 up-to-date methods and processes in tool and manufacturing engineering?

For a lot less, only $2.50, you can have such knowledge at your fingertips. At this nominal cost price the Society will deliver to you all the papers presented at the 19th annual meeting in New York, plus written discussions on these talks, by more than 40 specialists in their respective fields. All bound in one volume of nearly 400 pages, complete with photo illustrations, drawings, charts. If you missed this topnotch program, here's your opportunity to get the lowdown.

Fill in the form, attach your check, mail to headquarters, and the ASTE 1951 national technical sessions will be on their way to you.

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If you don't want the big economy package, you can get individual papers for 50c per copy. See page 80, March Tool Engineer for program. List titles here:

.....

Make checks payable to Society. Do not send currency.

Cost Cutting Ideas Keep Audience Scribbling

Boston, Mass.—For their first meeting of the new chapter year, 248 Boston tool engineers turned out April 12 to hear a technical program geared to today's fast tempo of production.

The main subject, "Kirksite Dies—An Aid to Low Cost Tooling," was capably presented by W. W. Broughton, technical sales consultant for Newton-New Haven Co. and developer of Kirksite.

John Harrington, chief engineer, The Do-All Co., DesPlaines, Ill., discussed a companion topic, "Low Cost Tooling for Short Runs." Mr. Harrington kept his audience busy noting and sketching new ideas and machining methods.

The chapter's first chairman's service pin was awarded to Roy Hart of Pratt & Whitney by James Leone, immediate past chairman.

Sax Player Could Work Push Button Machines

Wichita, Kans.—Geared to the push button age, our modern machines could be operated by any good saxophone player.

C. B. DeVlieg, president of the DeVlieg Machine Co., made this quip while discussing "Precision and Production Boring Without Jigs" at the April 11 meeting of Wichita chapter.

To illustrate new principles in machine controlled boring, Mr. DeVlieg showed slides and color films demonstrating a combination of micrometer adjusted tools performing several operations in a single thrust. Also pictured were methods of loading, indexing and positioning of work, featuring shockless speed changing and tool chucking by push button control.

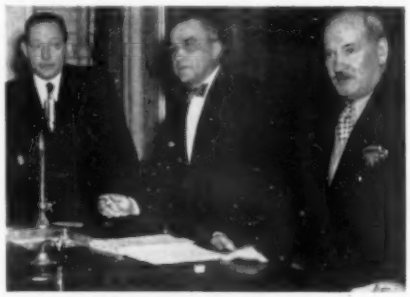
The speaker stressed the importance of time and cost savings with machines capable of working to extreme tolerances. In closing he reminded: "Each step of progress has been in direct relation to ability to control accuracy."

Demuth Heads ASTE Panel at Student Career Forum

Carbondale, Ill.—What the tool engineer can do for modern industrial production and what industry expects of him were presented by three Society representatives to Southern Illinois University students recently.

J. J. Demuth of St. Louis, ASTE president; E. P. Huchzermeier, first vice-chairman of St. Louis chapter, and E. A. Doogan, a former chairman, spoke to a group of 82 majors and minors in industrial education during a campus career conference.

Mr. Demuth, who acted as moderator, stressed honesty, sincerity of purpose, and frankness concerning personal qualifications as prime characteristics required of all employees. The college trained man, he cautioned, should be able to take the "bumps" without forming personal prejudices that would impair his efficiency.



E. A. Doogan (right), past chairman of St. Louis chapter, answers a student's question about tool engineering during a career conference at Southern Illinois University. At left are E. P. Huchzermeier, first vice-chairman of the chapter, and ASTE President J. J. Demuth, who moderated forum.

One of the problems that a tool designer faces, Mr. Doogan pointed out, is ability to sell his product to management and to labor. He urged the students to augment class work with extra-curricular drafting practice to develop superior techniques and skill. Competition in this field is strong, Mr. Doogan indicated.

Loyalty is among outstanding qualities that management demands of workers, Mr. Huchzermeier pointed out. For the well-trained, industrious and cooperative young man, there is excellent opportunity to work into junior executive positions, he added.

The students displayed lively interest, plying the speakers with questions for three hours after the close of the formal talks. The ASTE men were generous with time and knowledge in answering questions and in consulting with individuals.

Metal Cutting Offered In MIT Summer Course

Cambridge, Mass.—A two-week intensive program in metal cutting has been announced by Massachusetts Institute of Technology, from June 25 to July 6.

Purpose of the course is to broaden understanding of the mechanisms involved in cutting operations. Lectures by institute personnel and guest speakers will be augmented by laboratory exercises, demonstrations and discussions.

Prof. Prescott A. Smith, head of the machine tool laboratory of the Mechanical Engineering Department, will be co-director of the program. Professor Smith is chairman of the Boston ASTE chapter.

For information on this and other summer courses in industrial subjects, address Prof. Walter H. Gale, director of the Summer Session, Room 3-107, Massachusetts Institute of Technology, Cambridge 39, Mass.

Lehigh Elects Officers On First Anniversary

Allentown, Pa.—Lehigh Valley chapter celebrated its first birthday recently with a dinner meeting at Howard Johnson's Restaurant. Approximately 78 members and guests attended.

In an election conducted by Hobart T. Campbell, nominating chairman, the following candidates won office: J. R. Fairhurst, chairman; John Eaton, first vice-chairman; John J. Kling, second vice-chairman; Albert B. Carney, secretary; Joseph R. Danek, treasurer, and Eugene A. Pelizzoni, delegate.

A. H. Johnson of Pratt & Whitney gave a slide-illustrated lecture on modern percussion gages and their development.

Guests included T. J. Donovan, Jr., ASTE third vice-president; P. A. Patterson and Samuel Boyer, all of Philadelphia chapter.

John Harrington (left) of The DoAll Co., C. L. Sadon, technical chairman at Boston chapter, and W. W. Broughton of Newton-New Haven Co. have dinner table discussion of short run tooling.

Nearly Half of Wartime Aircraft Tooling Unsuitable

Garden City, N. Y.—Forty percent of the jigs, fixtures and other tools built for military aircraft production during World War II were never used in their original form. Aircraft design changes, methods changes, and production requirements made it necessary to replace, modify, or repair this equipment before it could be used.

Capt. Carlyle L. Helber, Bureau of Aeronautics representative from the New York Naval Shipyard, loosed this thunderbolt as prelude to his talk, "Performance vs. Producibility," at the April 17 meeting of the newly chartered Long Island chapter. He based his statement on government statistics.

Need High Output, Performance

Tool engineers, according to Captain Helber, should understand factors determining aircraft design changes. The designer demands the utmost in performance, while the production man wants maximum output.

Early in a war, the captain explained, performance is the uppermost consideration. If a pilot feels that enemy equipment is superior, he loses confidence in his own, its manufacturer, and his military leadership.

Tooling for the maximum both in performance and production is expensive. "M-day" planning helps reduce this cost with advance manufacturing studies and methods analyses.

As a war progresses to the extent that the enemy can no longer match our equipment performance effectively, producibility becomes the primary consideration.

Must Maintain Delicate Balance

The ideal balance is a firm but flexible line somewhere between performance and producibility. Movement of this line in either direction requires complex calculation. Design change decisions are based on original cost of existing equipment plus the expense of modification to meet new performance requirements.

Companies producing standard, unimproved items simply because they are tooled for these parts antagonize the military. Eventually such firms lose out, when competition not tooled for these parts develops better ones.

The program opened with a film, "Fighting Lady's Family," depicting naval air operations and demonstrating the need for performance and production.

In his talk Captain Helber stressed that the views expressed were his own and not necessarily the official opinion of the Navy Department.

Materials Supply Is Industry's Headache

Kansas City, Mo.—Industry's big problem today is stretching available materials to the utmost and finding adequate substitutes for unobtainable ones. Dr. Robert Howard of Black, Sivalls & Bryson, Inc., stressed this in a talk on critical metals and alloys, given April 4 before a dinner meeting of Kansas City chapter.

According to Dr. Howard major factors involved in selecting substitutes are: costs of new material, of machining and placing it in service, and its behavior in use.

The speaker also discussed the alloying of steels, listing reasons for adding these hardening agents.

A discussion followed on elements used in alloying steel, their sources and availability.

Norton Promotes Ogg

Worcester, Mass.—Wilfred R. Ogg of Worcester chapter, has been appointed Chicago district sales manager for Norton Co.

Mr. Ogg was formerly New England sales representative for this concern.

Stewart Cites Advantages Of Air and Hydraulics

Baltimore, Md.—Potential benefits of air and hydraulic power applications to machine tools were brought before Baltimore chapter members in a talk by H. L. Stewart of Logansport Machine Co., April 4, at the Engineers Club.

Mr. Stewart's slide-supplemented talk dealt with the theory, application and components of this equipment.

As coffee speaker, Leslie MacGregor, a charter member of the chapter, discussed a current industrial problem, "Too Old at 45?"

Willaim Schukraft, chapter chairman, introduced the speakers and the following past chairmen: Stanley S. Johns, Godfrey Steiner, Daryl Winger, Thomas Burke, Andrew Jones and Robert Brickett.

At the close of the meeting refreshments were served to approximately 60 members and guests.

Situations Wanted

GRINDING AND CUTTING TOOL ENGINEER—On all types of precision grinding. Age 40 with 23 years' experience as plant superintendent, general foreman, foreman and operator. Available within two weeks of acceptance. Box 233, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

PLANT SUPERINTENDENT OR TROUBLE SHOOTER—Now employed as superintendent in charge of all manufacturing with large corporation. Seeks change for better opportunities. Age 40; has held positions as toolmaker, foreman and general foreman. Resumé on request. Box 234, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

North Texas Chapter Installs Officers at Executives Night. Standing, from left: V. V. Koodroff, second vice-chairman; J. J. Vanderweel, treasurer; B. C. Greene, program chairman; I. A. Buck, past chairman; H. B. Osborn, Jr., national assistant secretary-treasurer, who installed officers; J. K. Turvene, chairman, and A. E. Unruh, first vice-chairman of the Southwest group.

Utah Group Has Ladies Night on Charter Anniversary, Other Chapters Open Year With Installation Ceremonies

Salt Lake City, Utah—Salt Lake City tool engineers brought their wives to the first anniversary celebration of the chapter's charter night. The ladies night dinner was held March 9 at Rose Garden Inn.

Chairman Leslie Seager reported on the year's activities and presented the chairman's award pin to Professor Frederick Preator for obtaining tool engineering recognition by the Utah State Agricultural College.

Hazewinkel Swears in Officers

B. J. Hazewinkel, national director from Denver, Colo., installed the following officers: Leslie C. Seager, chairman; John F. Woodhead, first vice-chairman; Frederick Preator, second vice-chairman; Ray Hogan, treasurer, and Richard H. May, secretary. Mr. Seager and Professor Preator were re-elected to their charter offices.

Professor Preator presented the chapter's first scholarships to two Utah State freshmen. Dell K. Allen of Richmond and Keith Naegle of Tooele, Utah, each received a $100 award for outstanding work in tool engineering classes taught by Professor Preator.

Donors of the scholarships are McGee-Hogan Machine Works and EIMCO Corp., both of Salt Lake City.

The evening concluded with entertainment and dancing.

DAYTON, OHIO—E. V. Crane, chief engineer of E. W. Bliss Co., addressed the installation night meeting of Dayton chapter on March 12.

An author of books on pressworking, Mr. Crane discussed "Metal Pressing Theory and Practice." Slides highlighted his lecture.

In a resume of the year's activities, C. R. Miller, chapter chairman, reported a steadily growing membership of 304. Mr. Miller was presented with a past chairman pin.

A special merit award for outstanding service was made to E. J. Seifreat, a former chairman.

George Tillotson, also a past chairman, installed the new officers.

An Auditing Committee, appointed during the evening, consists of Paul Chatelein, Milton Ahlers and Charles Hayes.

For outstanding work in tool engineering classes at Utah State Agricultural College, Dell K. Allen and Keith Naegle receive Salt Lake City chapter's first scholarships, from Prof. Frederick Preator.

NEWARK, N. J.—Executives Night at Northern New Jersey chapter was dedicated to Hyatt Roller Bearing Co. The annual function was held March 13 at Robert Treat Hotel.

A delegation of national officers, directors and committeemen came from the Society's annual meeting in New York to attend the dinner meeting. These included J. J. Demuth of St. Louis, president; T. J. Donovan, Jr., Philadelphia, third vice-president; B. J. Hazewinkel, Denver, V. H. Ericson, Worcester, Fred J. Schmitt, Chicago, and A. D. Lewis, Los Angeles, all directors, and B. C. Brosheer, Chicago, book committee.

Acting as toastmaster, A. H. Lundius, works manager at Hyatt, introduced the distinguished guests.

The chapter's officers-elect were installed by Mr. Demuth. Before retiring from office, Albert J. Schmidt, outgoing chairman, presented the service award pin to William E. Wheaton, editorial chairman.

Principal speaker was William H. Chapman, director of engineering at Hyatt Roller Bearing Co. Mr. Chapman detailed the "Design, Application and Methods of Manufacture of Roller Bearings."

TOLEDO, OHIO—H. L. Tigges, retiring ASTE president, installed the new officers of his home chapter at a meeting held March 7 at the Secor Hotel.

Participating in the ceremony were: Dale H. Burke, chairman; Elmer L. Faber, first vice-chairman; Joseph J. Kertz, second vice- chairman; Richard B. Sullivan, secretary, and Walter Toepfer, treasurer.

Following the installation Chairman Burke named his committee chairmen.

Kessler Awarded Service Pin

Raymond Peterson, the outgoing chairman, gave his annual report and presented the chairman's service award to Val G. Kessler.

Principal speaker was James Y. Scott, president of the Van Norman Co. Mr. Scott gave his address, "America, 1951 Model," previously delivered before other chapters.

As toastmaster Judge Harvey G. Straub introduced Mr. Scott and other distinguished guests, including First Vice-President Leslie B. Bellamy, who spoke briefly.

GALT, ONT.—Two national officers were honor guests at Grand River Valley's installation night. Leslie Bellamy, first vice-president, assisted by W. A.

Left: The men who will fill Dayton chapter offices for '51-52 are from left, seated: R. M. Blair, first vice-chairman, L. R. McAfee, chairman; (standing): C. R. Miller, delegate; John Kitts, treasurer; R. A. Miller, second vice-chairman; and William Lawrence, secretary.

Right: President J. J. Demuth, congratulates William Chapman of Hyatt Roller Bearing Co. on lecture at Northern New Jersey chapter's Executives Night. From left are: A. H. Lundius, also of Hyatt, A. J. Schmidt, chapter chairman; Mr. Chapman and Mr. Demuth.

Thomas, national secretary, performed the ceremony of inducting the new officers at a meeting March 2 in Moffats Hall, Galt. Sixty members and guests witnessed the inauguration.

Those taking the oath of office were: Harry Sehl, chairman; William Copp, first vice-chairman; John Ward, second vice-chairman; S. S. Pritchard, third vice-chairman; Percy Barber, secretary, and David McCready, treasurer.

Harry Whitehall, retiring chairman, congratulated the membership on its choice of officers and wished the new executives success. Mr. Whitehall also thanked the retiring officers for their efforts during his administration.

Hawley Cited for Service

Carl Hawley, who handled all ticket sales and accommodation arrangements for chapter functions during the year, received the chairman's award pin.

The technical subject, "Mechanisms of Metal Cutting With Special Emphasis on Cutting Fluids and Tools," was presented by W. H. Oldacre, president and general manager of D. A. Stuart Oil Co.

Accompanying his talk with slides, Mr. Oldacre detailed types of coolants used in grinding and milling, as well as correct application to prevent corrosion. He stressed coordination of cutting fluids with tools.

Clyde Woodburn introduced the speaker and Charles Spicer thanked him for his presentation.

At the close of the meeting a buffet luncheon was served.

SAN FRANCISCO, CALIF.—Golden Gate members learned the possibilities of repairing chipped or broken tools and dies by welding with tool steel, at their March 21 meeting in El Curtola Restaurant, Oakland.

Through a series of slides A. E. Yoeman of E. T. Lombard Co., Oakland, explained the various stages of the welding process.

During a business meeting Floyd Snodgrass, a past chairman, installed the following officers: G. B. Berlien, chairman; T. J. Rohrer, first vice-chairman; D. A. Gustafson, second vice-chairman; J. E. Moeller, secretary, and Dean Rouland, treasurer.

DOVER, N. H.—"Atomic Energy Developments Behind the Iron Curtain" brought out a record crowd for Granite State's March 13 meeting at the American House.

Discusses Russian Paper

Prof. Vladimir Drotsky, eminent atomic scientist of Durham, N.H., went into a detailed explanation of nuclear physics, with illustrations and formulas. His lecture was a simplification of a paper published in the Soviet Academy of Science Journal.

Prior to Professor Drotsky's address, William Young of Boston, a former director, installed officers elected for the 1951-52 term. They are: Charles Nysted, chairman; Harold Perkins, first vice-chairman; John McInnes, sec-

New officers begin terms in four chapters. From top and from left: Twin Cities—Harold Sullivan, a past chairman, congratulates: P. S. Tobias, chairman; D. A. Reiner, first vice-chairman; C. E. Fasth, second vice-chairman; J. W. Schwartz, secretary, and R. M. Johnson, treasurer. Salt Lake City—B. J. Hazewinkel, Denver director, swears in: L. C. Seager, chairman; J. F. Woodhead, first vice-chairman; Frederick Preator, second vice-chairman; Ray Hogan, treasurer, and R. H. May, secretary. Central Pennsylvania—C. F. Stephenson, a former chairman, installs: D. A. Schron, chairman; B. C. Stambaugh, first vice-chairman; R. H. Meckley, second vice-chairman; E. T. Weinrich, secretary; W. W. Faw, delegate; L. D. Roberts, treasurer, and P. P. Stock, alternate. Boston—Wives are guests at induction ceremony for: John Leach, secretary; Harold Seekins, first vice-chairman; P. A. Smith, chairman; W. B. Wells, second vice-chairman, and Karl Nowak, treasurer of the Hub tool engineers.

Left: Elected to head up Montreal chapter are, from left: C. J. McDowell, first vice-chairman; T. C. Tracey, treasurer; J. P. Cloutier, chairman; J. M. Masse, secretary; T. C. Hill, third vice-chairman. C. A. Gareau, second vice-chairman, was not present when picture was taken. Right: Niagara District officers are installed by C. D. Wright, a past chairman. From left: F. W. Dunn, chairman; J. M. Marchyn, first vice-chairman; C. R. Mitchell, second vice-chairman; J. C. Caiger, secretary; Mr. Wright and H. J. Crawford, treasurer.

ond vice-chairman; Joseph Rousseau, secretary, and Richard Wiley, treasurer.

Jacob Mutzbauer of General Electric Co., Somersworth, N.H., received the chairman's award pin for his work in organizing the chapter, chartered last October.

Winner of the complimentary dinner award was John Woodman, the charter chairman. Mr. Woodman gave a farewell address before retiring from office.

UTICA, N. Y.—T. J. Donovan, Jr., ASTE third vice-president, played the dual role of technical speaker and installing officer at Mohawk valley chapter's March 27 meeting.

Machining Is Heat Treat Factor

Mr. Donovan, who heads a Philadelphia heat treating concern, discussed "Common Sense in Heat Treating." Proper machining to reduce stress is important to successful heat treatment, he said. The same amount of metal should be cut from both sides of a piece to neutralize strains.

The speaker also described techniques for normalizing, drawing, and quenching in water and oil. He answered questions from the floor at the conclusion of his talk.

New officers sworn in by Mr. Donovan are: Arnold K. Schroeder, chairman; Albert C. Delmont, first vice-chairman; Earl K. Wheat, second vice-chairman; Nicholas A. Kinney, treasurer, and Paul K. Lyman, secretary.

Fred Barker, chapter chairman, presided and introduced the speaker.

ST. CATHARINES, ONT.—Installation of 1951 officers opened the March meeting of Niagara District chapter.

C. D. Wright, charter chairman, administered the oath of office to: F. W. Dunn, chairman; J. M. Marchyn, first vice-chairman; C. R. Mitchell, second vice-chairman; J. C. Caiger, secretary, and H. J. Crawford, treasurer.

Films Demonstrate Brazing

Following the installation Samuel Knott of Handy & Harmon lectured on "Applications and Methods of Silver Alloy Brazing." With motion pictures he showed basic requirements to be met in obtaining a satisfactorily bonded joint, together with examples of practical applications.

In the ensuing discussion period the speaker outlined specific details of the brazing operations, giving estimates of resulting cost reductions and joint strength.

N. B. Coleman introduced the speaker and C. R. Mitchell thanked him on behalf of the chapter.

Past chairmen attending the meeting included: Henry Hendriks, Edward Dewar and Lloyd Sandham, in addition to Mr. Coleman and Mr. Wright.

CHICAGO, ILL.—How the FBI gets its man was related to 128 Chicago members and their guests by John A. Roche, head of the local office of this agency.

Speaking before the chapter's inaugural dinner, March 13, at the Furniture Club of America, Mr. Roche outlined the FBI's background and cited case histories of assignments. When he closed his talk the speaker was bombarded with questions.

Long Is Chairman

Roy Hoefer, a former chairman, inducted officers-elect: Harold D. Long, chairman; Verne H. Loeppert, first vice-chairman; Harry A. Paine, second vice-chairman; John H. Beck, third vice-chairman; Gordon J. Benes, secretary, and Joseph J. Kayda, treasurer. The third vice-chairmanship is a new office.

Frank Martindell, another former chairman, presented a past chairman pin to Thomas Barber. Mr. Barber responded and thanked his officers and committeemen before turning the gavel over to his successor.

Chairman Long spoke briefly on plans for the year ahead, before departing for the annual meeting in New York.

For his efforts in coordinating the student section and preparing a "Tool Engineering Primer" for high school students, H. H. Katz, education chairman, received the chairman's service pin.

New Committees Set Up

New committees established this year are: industrial relations, historian, book, and 1952 tool engineers exposition. The latter activity is chairmanned by Marshall Blu of the Sears, Roebuck manufacturing division.

LONG BEACH, CALIF.—In recognition of his work in organizing the Long Beach chapter, Lawrence D. Pomerantz has been awarded the chairman's service pin.

Before 60 members and guests attending the year-old chapter's March 14 dinner meeting at Ivan's Restaurant in Lynwood, John H. Stansbury, retiring chairman, pinned the honor emblem on Mr. Pomerantz.

After introducing the officers-elect, Mr. Stansbury administered the oath of office to: W. B. MacKay, chairman; F. C. Wallace, first vice-chairman; E. A. Smith, second vice-chairman; C. B.

Being introduced to chapter members are Long Beach officers, from left: E. A. Smith, second vice-chairman; John Morgan, treasurer; W. B. MacKay, chairman; J. H. Stansbury, past chairman; C. B. Edson, secretary, and F. D. Wallace, first vice-chairman.

Above: Evansville chapter officers repeat oath of office after Clyde Yost, a former chairman. From left: Mr. Yost, Arthur Ullman, treasurer; Bernard Pampe, secretary; Paul A. Vierling, second vice-chairman; Henry Pernicka, first vice-chairman, and Charles Thuman, chairman. Right: After lecturing on castings C. E. Herington of Meehanite Metals Corp. discusses exhibit. From left: E. V. Webb of Banner Iron Works, Mr. Herington, W. E. Illig, Banner Iron Works vice-president, who sponsored speaker, and Chairman Thuman.

Edson, secretary, and John Morgan, treasurer.

As Chairman MacKay took charge of the meeting he announced his committee chairmen: J. H. Lee, program; A. E. Andrews, membership; G. A. Milne, public relations; C. E. Blanchard, editorial; Louis Boer, education; J. D. Beach, constitution and by-laws; N. F. Hartnell, standards, and H. F. Robinson, historian.

Mr. Lee, the program chairman, presented the technical speaker, Earl P. Leeds of Brown & Sharpe Co. With the aid of slides Mr. Leeds explained why milling cutters are ground differently to obtain maximum efficiency with various speeds and materials.

A question and answer period following the talk brought out a number of other pointers on efficient milling.

Evansville, Ind.—C. E. Herington, manager of sales engineering development for the Meehanite Metal Corp., New Rochelle, N. Y., talked to Evansville members at their March 12 meeting in the Alpine House. Mr. Herington's subject was "Quality Castings, the Key to Greater Production."

Replaces Costly Steel

He told how cast iron is controlled to get finer grain structure, how to flame harden it, its structural advantages, and its uses. In addition the speaker explained Meehanite applications to replace more expensive tool steels. Slides and a sound film accompanied his talk.

W. E. Illig, vice-president of Banner Iron Works, St. Louis, Mo., and sponsor of the program, and E. V. Webb of the Banner sales department were guests. Program chairman for the evening was Louis Rothert of Bootz Mfg. Co.

New officers installed during the meeting are: Charles Thuman, chairman; Henry Pernicka, first vice-chairman; Paul Vierling, second vice-chairman; Bernard Pampe, secretary, and Arthur Ullman, treasurer.

About 60 members and guests attended the meeting.

Williamsport, Pa.—A technical session "on location" highlighted the March 12 dinner meeting of Williamsport chapter at the Anglers Club.

Demonstrates Salvage Welding

Fifty-two members and visitors adjourned to the Newberry Garage to see Herman J. Greif, of Eutectic Welding Alloys Corp. demonstrate the use of fluxes and welding rods in salvaging cutting tools and small assemblies. Slides showed large repair jobs done by low temperature welding.

T. J. Donovan, Jr. of Philadelphia, ASTE third vice-president, installed the newly elected officers. Mr. Donovan also spoke briefly on how "The Tool Engineer Needs Industry and Industry Needs the Tool Engineer."

William Belknap, the outgoing chairman, awarded the chairman's service pin to William Paul, who had taken the responsibility for all audio-visual aids through the past season. Mr. Paul presented two General Motors films during the evening.

Philadelphia, Pa.—Shaving and hobbing—two important processes in gear production—were compared for Philadelphia members in a symposium presented March 15 at the Engineers Club.

Ben F. Bregi of the National Broach and Machine Co. and Fred Bohle of Illinois Tool Works each delivered a comprehensive, slide illustrated lecture.

The open forum which followed seemed to bring about the following conclusions: Hobbing is a fast method of gear cutting, producing good tooth spacing. Tooth form, size control and finish are secondary characteristics and depend on the precision of the hob and the care exercised in making the setup, according to Mr. Bohle.

Shaving Improves Gear

Shaving, as described by Mr. Bregi, will make a good gear better. It can improve tooth form, correct both a runout condition and a small amount of tooth space error. On production jobs one shaving machine can handle work from three to eight hobbing machines.

Mr. Bregi also explained the benefits of tooth crowning. A tooth which is thicker in the middle than at the ends can carry the gear load through this strong center without concentrated end stresses.

During a business session L. S. Paulsen, retiring chairman, read a summary of the activities of his term in office.

In reporting the financial status of the chapter, Frank DeFrates, treasurer, commented on items emphasizing the splendid work of the outgoing administration.

Fred Bohle (left) of Illinois Tool Co. and William Griffith, Philadelphia chapter chairman, admire gear design on necktie of Ben Bregi of National Broach and Machine Co. Mr. Bohle and Mr. Bregi were speakers on chapter's gear finishing symposium.

The newly installed chapter chairman, William Griffith, introduced his committee chairmen for the coming year as follows: Walter Czarnecki, public relations; Harry Wood, editorial; Leslie Rielley, education; Robert Lowry, program; Roy Paulsen, constitution and by-laws; P. A. Patterson, scholarship; Foster Crayton, chaplain; Harry Smithgall, standards; Albert Morris, membership; Paul Nochel, good and welfare; Charles Lennig, Jr., register and reception; Walter Phifer, finance; William Pinkstone, entertainment, and

Milwaukee Journal Photo

Walter Behrend (right, seated), Milwaukee chapter chairman, accepts giant gavel. Other officers looking on are, from left, rear: Eugene Anspach, second vice-chairman; Ralph Bieszk, treasurer; Robert Bodendoerfer, secretary; and (front): Waldemar Klein, first vice-chairman.

Edmund Hollingsworth, industrial relations.

NASHVILLE, TENN.—Engineering characteristics of Formica plastics were presented to Nashville members at the March 20 meeting of the chapter. J. H. Curran, field engineer for the Formica Co., was the technical speaker.

After showing two films, Mr. Curran answered questions and displayed samples.

The dinner meeting at the Andrew Jackson Hotel opened with an impressive installation of officers by Fred Wright, chapter chairman.

FLINT, MICH.—The men who have headed Saginaw Valley chapter since its chartering in 1945 were guests at a past chairman night held March 22 at the Zehnder Hotel in Frankenmuth.

Those honored were: Michael Skunda, L. A. Kitchen, Norman Snyder, Ralph Cook, Harold Devore, and Benjamin Phillips.

Bellamy Inducts New Chairman

L. B. Bellamy of Detroit, ASTE first vice-president, swore in Russell Ayers, the 1951 chairman and his staff of officers.

Sixty-eight members and guests attended the function.

CEDAR RAPIDS, IOWA—The tool engineer should become an integrated part of every company's methods program. H. T. Amrine, associate professor of industrial engineering at Purdue University, left this thought with the 46 members and 12 guests attending a Cedar Rapids chapter meeting March 21 at the Montrose Hotel.

Motion study, he said, is one of the keys to increased production. Since the tool engineer plays a prominent role in the production picture, it is increasingly important that he become thoroughly familiar with all the tools available to him.

Professor Amrine illustrated with industrial examples, slides and motion pictures some of the ways in which tool engineers can apply the principles of motion study.

Edwin F. Klouda, second vice-chairman, introduced the professor.

Following an intermission Elliott H. Wheeler, the retiring chairman, read the oath of office to: W. D. Popek, chairman; Edwin F. Klouda, first vice-chairman; Richard L. Coyner, second vice-chairman; Carroll F. Bryant, secretary, and Kenneth E. Ferguson, treasurer.

Popek Honored for Service

Before surrendering the gavel, Mr. Wheeler presented the service award to Mr. Popek in appreciation of meritorious service throughout the year. As coffee speaker, Major Charles Brooks, U.S.A.F., of the Military Department, Coe College, Cedar Rapids, recounted exciting experiences during 34 months as base rescue officer at Goose Bay, Labrador, during World War II.

Servicing aircraft at 50° below zero is nearly as harrowing as climbing the Greenland icecap with its hazards of seemingly bottomless crevasses and 200-mile-an-hour winds, Major Brooks indicated.

SOUTH BEND, IND.—Herbert A. Goltz, was installed as chairman of South Bend chapter at the March 13 dinner meeting at the American Veterans Clubhouse.

Other officers sworn in by Paul Beeler are: Walter Prohaska, first vice-chairman; James L. Kemp, second vice-chairman; Harold Housewerth, secretary, and Preston H. Bidwell, treasurer.

J. R. Reinertson, midwest engineer for Pivot Punch and Die Corp., North Tonawanda, N.Y., was the principal speaker. Following his discussion of "Punch Press Problems," Mr. Reinertson exhibited unusual applications of high speed steel.

A group of South Bend officers inspect samples displayed by J. R. Reinertson of Pivot Punch and Die Corp. From left: John Yoder, outgoing chairman; Mr. Reinertson, H. A. Goltz, chairman, and Walter Prohaska, vice-chairman.

Peoria Has Family Night

Peoria, Ill.—April meeting of Peoria chapter was designated Family Night and attended by 170 members and their wives.

Speaker of the evening was William E. Skadden, lecturer, writer, humorist and philosopher. His subject was "Marry and Be Merry." At times the room was quiet with the serious aspects of his lecture, then it resounded with laughter from the speaker's humorous interpolations.

His forceful and witty presentation made the substance of his address stick in the minds of his listeners.

The men who have headed Saginaw Valley chapter since its founding are honored with a past chairman night. From left: Russell Ayers, incumbent; B. J. Phillips, L. B. Bellamy of Detroit, first vice-president; Clifford Bendle of Ann Arbor, a guest; Michael Skunda, L. A. Kitchen, Norman Snyder, Ralph Cook and Harold Devore.

Meehan Outlines Steps In Cylindrical Grinding

Galt, Ont.—From stock centering to final gaging of the finished part, the ten major steps in precision cylindrical grinding were detailed recently for Grand River Valley members by James Meehan, sales director for Brown & Sharpe Co., Providence, R.I. Mr. Meehan was introduced by W. W. Appleton, Brown & Sharpe Canadian sales representative.

Shows High Production Gaging

A color-sound film demonstration of the Electroline method of precision gaging highlighted the evening. The application of electronic measuring through amplification was chiefly concerned with high production runs.

David McCready thanked the speaker for his informative presentation.

The technical session followed a business meeting and election of officers. A slate, proposed by Charles Spicer, nominating chairman, was accepted by the membership as follows: Harry Sehl, chairman; William Copp, first vice-chairman; John Ward, second vice-chairman; Selwyn Pritchard, third vice-chairman; Percy Barber, secretary, and David McCready, treasurer.

Harry Sehl, first vice-chairman, presided and welcomed some 75 members and guests to the dinner meeting at Moffat's Hall.

Kugler Talks on Welding

Worcester, Mass.—Arthur N. Kugler, mechanical engineer for Air Reduction Sales Co., addressed Worcester chapter's April 3 meeting at Putnam & Thurston's.

His discussion of "Inert Gas Arc Welding" included Heliwelding and Aircomatic welding. Slides and a film, "The Tool for the Job," supplemented his talk. A question and answer period followed.

During a business meeting preceding the technical session Carroll L. Morse, chapter delegate, reported on the Society's annual meeting at New York.

NPA Appoints Anderson

St. Louis, Mo.—Ralph O. Anderson, Norton Co. district manager in St. Louis, has been appointed by the National Production Authority to serve as abrasive consultant in its machinery division. Announcement was made recently by Ralph M. Johnson, Norton vice-president.

Mr. Anderson will be on loan to the government as a representative of the abrasive industry. The St. Louis ASTE member joined Norton in 1912 and has served as abrasive engineer and district manager in the midwest and southwest.

J. A. Cupler of National Jet Co. sets up demonstration of micro-drilling for E. W. Hilkenbach, Indianapolis chairman, to view through binoculars as members crowd around waiting for a turn.

Sees Instrument Gaging As Fast, Economical

Poughkeepsie, N.Y.—Frank W. Blanchette, consulting engineer for The Sheffield Corp., Dayton, Ohio, named advantages of modern instrument gaging for Mid-Hudson chapter members at their April 10 meeting.

In discussing tolerances Mr. Blanchette explained that the Ordnance Department favors unilateral gage tolerance—all minus on a ring gage and plus on a plug gage. But the automotive industry prefers a bilateral tolerance—a little plus or minus on both the ring and plug gages, for greater leeway.

Eliminates Delay, Rejects

With instrument gaging, Mr. Blanchette observed, the dimension is registered, giving information for establishing quality control standards. Using slides the speaker demonstrated how the speed and uniformity of instrument gaging eliminates costly delays and rejects of spoiled parts.

Among non-conduct gages shown was the Measuray for gaging hot mill steel by measuring the X-rays passing through a continuously moving strip.

Prior to the technical talk, Joseph L. Petz of the National Editorial Committee, outlined changes in the format and contents of *The Tool Engineer*.

Ellis Thorp, chapter delegate, reported the proceedings of the house of delegates and the technical sessions at the annual meeting in New York.

William W. Schug, chapter chairman, presided. Attendance at the meeting numbered about 70.

Skeptics View Drilling Through Binoculars

Indianapolis, Ind.—At the April 5 meeting of Indianapolis chapter J. A. Cupler II of the National Jet Co. conducted a discussion of the "Technique of Micro-Drilling." Mr. Cupler explained advances in this field and production applications adopted by industry.

Following the lecture, skeptics were invited to witness the actual drilling operation through 20-power binoculars. The entire gathering lined up.

R. F. Krause, delegate, reported on the proceedings of the national meeting at New York. Dinner was served to approximately 84 members and guests before the meeting opened.

Position Available

TOOL SUPERINTENDENT—With aircraft engine experience or equivalent, for immediate opening in midwest. Must be capable of managing tool planning, designing and tool fabrication department; also subcontracting to outside tool suppliers. Engineering background and proven administrative ability necessary.

Aggressive, hard working individual is needed to fit into immediate program on jet engines. Exceptional opportunity for the future. Give complete information on qualifications, experience, and salary expected. Box 232, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

Not all winners but a happy crowd at the odds wheel run by Past Chairman Glenn Hier at Cleveland's Wild West Monte Carlo party.

Big Stakes Change Hands At Cowhand Monte Carlo

Cleveland, Ohio—Friday the 13th was a lucky day for some Cleveland members and their wives. The fortunate ones were winners at the chapter's Wild West Monte Carlo party. A revival of a former annual event, the April affair was attended by about 200 "gamblers," many in Western costume.

Gift certificates were awarded as door prizes, with a special prize for the player holding the most stage money at the close of the fun fest.

Andrew B. Clark, national membership chairman and chapter program chairman, spoke briefly on these two phases of Society activity.

Coming Meetings

CHICAGO—March 17-21, 1952. Tool Engineers Industrial Exposition.

EVANSVILLE—July 9. Annual picnic and stag, Servel picnic grounds.

(FLINT, MICH.) SAGINAW VALLEY—June 16. Outing.

HARTFORD—June 7. Hartford Night, in cooperation with Fairfield County and New Haven chapters; 9:30 a.m.-3:00 p.m., plant tours; 3:30, thread rolling symposium, Hotel Bond; 5:00 p.m., social hour and ordnance exhibit; 6:30 p.m., dinner. Speaker: Roger E. Gay, president, Bristol Brass Co. Subject: "This Jig Can Be No Fixture."

PHILADELPHIA—June 2. Outing, Philadelphia Rifle Club.

RACINE—June 8, 12:00 noon. Brown's Lake Golf Course and Liggets' Royal Palm Garden. Annual Frolic.

WORCESTER—Smorgasbord at Svea Gille. Subject: "Controlled Air Power" presented by The Bellows Co.

Philadelphia Swaps Ideas On Member Promotion

Philadelphia, Pa.—Eager to hold and improve its closely contested third place in membership rank, Philadelphia chapter has initiated a program of visits to other chapters to study operations and membership promotion activities.

For their first trip Robert A. Lowry, tool engineer with Link-Belt Co., and Albert N. Morris, district manager for Bay State Tap & Die Co., called on Detroit chapter recently. Mr. Lowry is the retiring chairman and Mr. Morris the incumbent head of the Philadelphia ASTE Membership Committee.

Charles M. Smillie, retiring Detroit chairman, welcomed and introduced the visitors. At the close of the meeting the out-of-town membership men conferred with Mr. Smillie and other Detroit officers. Both groups benefited by the interchange of ideas for chapter conduct.

During their stay at Detroit, the Pennsylvania members enjoyed a personally conducted tour of the Ford Motor Co. Rouge plant in Dearborn, arranged through ASTE headquarters.

Almdale Made Manager

Detroit, Mich.—E. R. Almdale has been appointed Michigan district manager by Carboloy Co., Inc.

A graduate of St. Johns Military Academy and of the University of Michigan, the Detroit ASTE'er joined Carboloy upon receiving his degree in mechanical engineering and metal processing in 1940. Since then he has held various engineering and sales posts.

He has contributed technical literature on milling steel and has been instrumental in developing carbide applications in important industrial and mining processes.

Obituaries

Raymond A. Kaltwasser

Raymond A. Kaltwasser, 53, president of General Metal Products Co., St. Louis, Mo. for 32 years, died February 13 in a Hannibal, Mo. hospital, following several heart attacks.

Ill for several years, Mr. Kaltwasser had recently undergone a serious operation.

He reorganized the General Metal Products Co. in 1919 and was active in the reorganization of other corporations.

Mr. Kaltwasser was also instrumental in the organization of the St. Louis ASTE chapter. Preliminary meetings with national officers were held in his private office when the chapter was being formed early in 1938. But he modestly declined office in the group he had helped found.

His interest and efforts in behalf of the chapter were an inspiration to the officers and members. In 1944 he was accorded special recognition when a testimonial plaque was presented to him by the chapter.

Victor E. Nagle

Victor E. Nagle, 55, Detroit area representative for J. H. Williams & Co., Buffalo, N. Y., died March 14 at Grace Hospital, Detroit.

Born in Brooklyn, N. Y., Mr. Nagle attended schools in that city. Since joining J. H. Williams & Co. in 1909 as office boy, he had served in various capacities, for the past 31 years as sales representative.

Mr. Nagle was affiliated with the Detroit ASTE chapter.

Harry G. Procunier

Harry G. Procunier, president of Procunier Safety Chuck Co., Chicago, Ill., passed away February 2, two weeks before his 60th birthday.

Prior to his association with the Procunier company in 1918, the Chicago chapter member had been employed at Ford Motor Co. and Potter & Johnston.

Elected Executive V. P. By New Britain Machine

Hartford, Conn.—Two Hartford members figured in recent administrative changes in the New Britain Machine Co., announced by Herbert H. Pease, board chairman, following the annual directors meeting.

Ralph S. Howe, formerly vice-president, has been elected executive vice-president. Mr. Pease retires as president, continuing as chairman of the board.

Directory of A.S.T.E. Chapter Chairmen

AKRON, C-47
Third Monday*
A. O. Hunt, 124 N. Harmony St., Medina, O.

ATLANTA, C-61
Third Monday*
Clarence E. Redfern, Auto Soler Co., 267 Marietta St., N.W., Atlanta 3, Ga.

BALTIMORE, C-13
First Wednesday*
John W. Schukraft, 1213 E. Belvedere, Baltimore 12, Md.

BINGHAMTON, C-35
1st Wed. after 1st Mon.*
Donald L. Ellis, 97 Front St., Vestal, N.Y.

BOSTON, C-33
Second Thursday*
Prescott A. Smith, Mass. Inst. of Tech., 77 Massachusetts, Cambridge 39, Mass.

BUFFALO-NIAGARA FRONTIER, C-10
Second Wednesday*
Wilbur J. Reich, 1036 Town Line Rd., Lancaster, N.Y.

CEDAR RAPIDS, C-71
Third Wednesday*
W. D. Popek, 833 14th St., S.E., Cedar Rapids, Ia.

CENTRAL PENNSYLVANIA, C-22
First Monday*
David A. Schrom, 554 Pacific Ave., York, Pa.

CHICAGO, C-5
Second Tuesday*
Harold D. Long, 1901 S. Rockwell, Chicago 8, Ill.

CINCINNATI, C-21
Second Tuesday*
Edgar L. Routzong, 6131 Robison Rd., Cincinnati 13, O.

CLEVELAND, C-3
Second Friday*
R. C. Southwell, 2025 Belvoir Blvd., Cleveland 12, O.

COLUMBUS, C-36
Second Wednesday*
Milner D. Sherman, 2745 Camden Rd., Columbus 12, O.

DAYTON, C-18
Second Monday*
Lawrence R. McAfee, Peninsular Steel Co., 401 Kiser St., Dayton 4, O.

DECATUR, C-58
Last Tuesday*
James H. Clark, 1090 W. Tuttle, Decatur, Ill.

DENVER, C-77
First Wednesday*
Warren L. Foss, 930 S. Elizabeth, Denver 9, Colo.

DES MOINES, C-80
Third Wednesday*
Clyde Allen, 836 Douglas, Des Moines 13, Ia.

DETROIT, C-1
Second Thursday*
John D. Anderson, 13860 Fairmount Dr., Detroit 5, Mich.

ELMIRA, C-24
First Monday*
Henry G. Lemaire, RD 1, River Rd., Elmira, N.Y.

ERIE, C-62
First Tuesday*
Robert J. Wilson, Jr., 10 Henry St., Warren, Pa.

EVANSVILLE, C-73
Second Monday*
Charles H. Thuman, Seeger Refrigerator Co., 225 W. Morgan Ave., Evansville 7, Ind.

FAIRFIELD COUNTY, C-6
First Wednesday*
Douglas F. Linsley, 250 S. Compo Rd., Westport, Conn.

FOND DU LAC, C-45
Second Friday*
Charles Billberg, Wisc. Axle Div., 567 High St., Oshkosh, Wis.

FORT WAYNE, C-56
Second Wednesday*
Ralph J. Didier, 2501 Wayne Trace, Ft. Wayne 4, Ind.

FOX RIVER VALLEY, C-72
First Tuesday*
George Bodi, 519 Edwards St., Aurora, Ill.

GOLDEN GATE, C-28
Third Wednesday*
G. B. Berlien, Ind. Steel Treating, 600 Fallon St., Oakland, Calif.

GRAND RIVER VALLEY, C-81
Third Tuesday*
Harry J. Sehl, Sehl Eng'g. Co., Kitchener, Ont., Can.

GRANITE STATE, C-86
Second Tuesday*
Charles M. Nystedt, 24 Meadow Rd., Durham, N.H.

HAMILTON, C-42
Second Friday*
J. E. R. Yorick, 105 Sterling St., Hamilton, Ont., Can.

HARTFORD, C-7
First Monday*
R. M. Toppin, Jacobs Mfg. Co., W. Hartford, Conn.

HOUSTON, C-29
Second Tuesday*
Robert E. Schuller, 7024 Avenue N., Houston 11, Texas

INDIANAPOLIS, C-37
First Thursday*
Ernest W. Hilkenbach, 2433 N. Illinois St., Indianapolis 8, Ind.

JACKSON, C-87
Frank E. Gokay, 334 Hibbard, Jackson, Mich.

KANSAS CITY, C-57
First Wednesday*
Ivan J. Nelson, 2239 Garfield Ave., Kansas City 2, Kans.

LEHIGH VALLEY, C-83
Third Friday*
James R. Fairhurst, 91 Harte, Phillipsburg, N.J.

LITTLE RHODY, C-53
First Thursday*
C. B. George, 276 Niantic Ave., Providence 7, R.I.

LONG BEACH, C-84
Second Wednesday*
William B. Mackay, 260½ Glendora Ave., Long Beach 3, Calif.

LONG ISLAND, C-88
Henry Maehl, Ranger Aircraft Eng'g, Fairchild Engine Div., Conklin Ave., Farmingdale, L.I., N.Y.

LOS ANGELES, C-27
Second Thursday*
G. J. Walkey, 1524 Pepper St., Burbank, Calif.

LOUISVILLE, C-54
Second Wednesday*
W. D. Wuest, 916 Greenleaf Rd., Louisville 13, Ky.

MADISON, C-75
1st Tues. after 1st Mon.*
A. G. Hoffer, Gisholt Mach. Co., 1245 E. Washington, Madison 10, Wis.

MID-HUDSON, C-74
Second Tuesday*
William W. Schug, 8 Janis St., R.D. 2, Hudson, N.Y.

MILWAUKEE, C-4
Second Thursday*
Walter O. Behrend, 2817 N. 48th St., Milwaukee 10, Wis.

MOHAWK VALLEY, C-78
Fourth Tuesday
Arnold K. Schroeder, 2810 Leibel Pl., Utica 3, N.Y.

MONTREAL, C-50
Second Thursday*
J. P. Cloutier, 5035 Ontario E., Montreal, Que., Can.

MUNCIE, C-70
First Tuesday*
H. L. Mendenhall, N. Tillotson Ave., RFD 7, Muncie, Ind.

NASHVILLE, C-43
Third Tuesday*
A. Scobey Rogers, Jr., 2808 Westwood Ave., Nashville, Tenn.

NEW HAVEN, C-41
Second Thursday*
David J. Mathewson, Mathewson Tool Co., 28 Richards St., West Haven, Conn.

NEW YORK, GREATER, C-34
First Monday*
Joseph P. Schneider, 576 73rd St., Brooklyn 9, N.Y.

NIAGARA DISTRICT, C-65
First Thursday*
F. W. Dunn, 366 Church Rd., RR 5, St. Catharines, Ont., Can.

NORTH TEXAS, C-51
Last Friday*
John K. Turvene, 3003 Aster St., Dallas 11, Texas

NORTHERN NEW JERSEY, C-14
Second Tuesday*
James Allan, 285 Munroe Ave., Wyckoff, N.J.

PEORIA, C-31
First Tuesday*
Duane H. Brighton, 125 S. Eleanor, Peoria, Ill.

PHILADELPHIA, C-15
Third Thursday*
Willard J. Griffith, Rittenhouse Rd., Fairview Village, Pa.

PIEDMONT, C-82
Second Monday*
A. F. Moosbrugger, 14 F College Village, Winston Salem 5, N.C.

PITTSBURGH, C-8
First Friday*
W. J. Bickmore, 3942 Forbes St., Pittsburgh, Pa.

PONTIAC, C-69
Third Thursday*
John M. Fritcher, 933 Cameron Ave., Pontiac 17, Mich.

PORTLAND (ME.), C-46
Second Friday*
Carl A. Snow, 502 Deering Ave., Portland 5, Me.

PORTLAND (ORE.), C-63
Last Thursday*
Walter L. Brenneke, 2434 N. E. 21st Ave., Portland 12, Ore.

POTOMAC, C-48
1st Thurs. after 1st Mon.*
B. E. Thomasson, 4900 13th St., N., Arlington, Va.

RACINE, C-2
First Monday*
George S. Strombeck, Racine School of Voc. Adult Educ., 800 Center St., Racine, Wis.

RICHMOND, C-66
Second Tuesday*
Dezell Gibbs, Perfect Circle Corp., 522 S. Washington, Hagerstown, Ind.

ROCHESTER, C-16
First Monday*
James O. Horne, James O. Horne Co., 212 Powers Bldg., Rochester 14, N.Y.

ROCKFORD, C-12
First Wednesday*
George P. Torrence, Jr., Ingersoll Milling Mach. Co., Rockford, Ill.

SAGINAW VALLEY, C-68
Third Thursday*
Russell M. Ayers, 3410 Gratiot, Flint 3, Mich.

ST. LOUIS, C-17
First Thursday*
L. W. Greenblatt, Jr., 7814 Maplewood Ind. Ct., St. Louis 17, Mo.

SALT LAKE CITY, C-85
1st Fri. after 1st Wed.*
Leslie C. Seager, 1194 Crystal Ave., Salt Lake City 6, Utah

SAN DIEGO, C-44
Second Tuesday*
A. P. Manino, 4816 Federal Blvd., San Diego 2, Calif.

SCHENECTADY, C-20
Second Tuesday*
Benjamin E. Storrs, 37 Wallace St., Scotia 2, N.Y.

SEATTLE, C-39
Fourth Tuesday*
Francis L. Coenen, 400 W. Mercer St., Seattle 99, Wash.

SOUTH BEND, C-30
Second Tuesday*
H. A. Goltz, 1206 Portage Ave., South Bend, Ind.

SPRINGFIELD (ILL.), C-64
First Tuesday*
Roger W. Wallace, 1930 N. 6th St., Springfield, Ill.

SPRINGFIELD (OHIO), C-76
Fourth Thursday*
Eldon M. Neff, 1515 Maryland Ave., Springfield 20, O.

SPRINGFIELD (MASS.), C-32
Second Monday*
Jason G. Doubleday, North Rd., Hampden, Mass.

SYRACUSE, C-19
Second Tuesday*
Carl J. Hoffman, 21 Reed Parkway, Marcellus, N.Y.

TOLEDO, C-9
Second Wednesday*
Dale H. Burke, 4238 N. Lockwood Ave., Toledo 12, O.

TORONTO, C-26
First Wednesday*
Douglas R. Cooper, Can. Fairbanks Morse Co., 137 Harbour St., Toronto, Ont., Can.

TRI-CITIES, C-23
Second Wednesday*
Joseph Zelnio, 421 11th St., Moline, Ill.

TWIN CITIES, C-11
First Wednesday*
Peter S. Tobias, 4451 5th St., N.E., Minneapolis, Minn.

TWIN STATES, C-40
Second Wednesday*
Floyd J. McArthur, 2 Circular St., Springfield, Vt.

WATERLOO AREA, C-79
Last Wednesday*
James A. McCollum, 2015 Highland Dr., Ann Arbor, Mich.

WESTERN MICHIGAN, C-38
Second Monday*
Claude C. Hanish, 420 Elliott S.E., Grand Rapids 7, Mich.

WICHITA, C-52
Second Wednesday*
Hazen I. Dool, 847 Marcilene, Wichita 17, Kans.

WILLIAMSPORT, C-49
Second Monday*
Richard S. Huskin, 808 Lincoln Ave., Williamsport 31, Pa.

WINDSOR, C-55
Second Monday*
H. J. A. Chambers, Std. Mach. & Tool Co., 870 Ottawa St., Windsor, Ont., Can.

WORCESTER, C-25
First Tuesday*
Ralph A. Baker, Whitin Machine Wks., Whitinsville, Mass.

*Meeting Night

News in Metalworking . . .

NTMDA SPEAKERS URGE PLANNED PROGRAM

The nation's machine tool industry will be able to produce in 1951 less than one-third of what it turned out in 1941 according to R. K. LeBlond, president of R. K. LeBlond Machine Tool Co., who talked recently before the spring meeting of the National Machine Tool Builders' Association in Chicago. Mr. LeBlond blamed the lack of recognition that machine tools must come before tanks, guns, planes and other defense equipment can be rolled out, and stressed the fact that unless the present situation were changed, makers of that equipment would be unable to meet their schedules. He urged that a defense plan and program be initiated by Congress in order that the uncertainties facing the manufacturer of tools be wiped out and he might then continue with intelligent planning. These uncertainties, included materials, price and volume of production expected.

At the same meeting of NMTBA, M. A. Hollengreen, chairman of the Government Relations Committee and president of the Landis Tool Co., agreed with Mr. LeBlond when he cited the combination of manpower shortage, uncertain price regulation and absence of a blanket priority for raw materials as effectively checking the vital expansion of the machine tool industry. "The importance of the present situation", he said, "is that as yet the very foundation of our nation's defense program has not been laid."

WAREHOUSEMEN HEAR OF STEEL OUTLOOK FROM GOVERNMENT AND INDUSTRIAL AUTHORITIES

Of most especial interest to those in the trade who feel the uncertainty of steels for their production requirements were the talks at the recent American Steel Warehouse Association's 42nd annual convention in Chicago.

While principal speakers, Senator Everett M. Dirksen and Manly Fleischmann, Administrator of NPA emphasized National Defense and its requirements and explained necessary channelling to these efforts, other speakers brought the problem down to the how-much-is-there and the what-can-we-expect-to-get level.

Important among the points stressed by Harold B. Ressler, first vice-president of Joseph T. Ryerson & Son, Inc., was that inventories now on hand in various warehouses average about 40 percent of that a year ago, and, moreover, incoming shipments now to warehouses are substantially less. Stainless and alloy steels are in the shortest supply, although structural steel and plates also are becoming more difficult to obtain.

Charles R. Hook, chairman of Armco Steel Corp., declared that the country's steel making capacity would reach the 120-million-ingot tons annually point, possibly by the end of 1952, even though only last January that goal was hoped for by President Truman in "three or four" years. But with this productive outlook, Mr. Hook saw no easing of the steel-user's problem at present, and stressed the vital necessity for cooperation with NPA and other users in a fair-play share plan as the only way for all producers to continue, as well as the way to avoid unlimited government control of distribution.

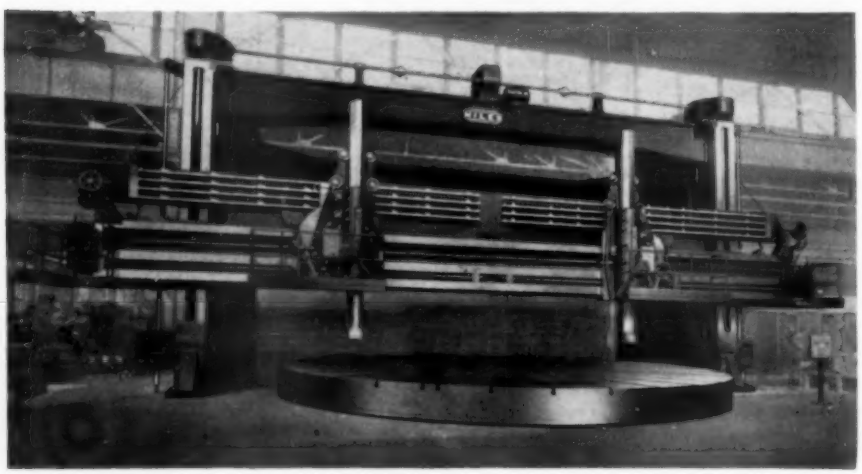
Walter Doxsey, president of the Association, in stressing several points, said that, unfortunately, difficulties in obtaining adequate supplies may continue well into 1952; that from January to April of this year, free steel was cut from 85 to 65 percent, complicated by defense orders plus directives outranking the defense orders. He pointed out, too, that restrictions reach also to zinc, nickel, molybdenum and other alloying elements; the much used sulphuric acid is scarce thus affecting galvanized sheets, alloys, stainless and tool steels. Alloy controls have now reached to the point where 30 to 35 percent is available for normal channels. He pointed out, however, that, as a group, warehouses are favored customers—getting about 85 percent of their needs under NPA Order M-6.

Warehouses serve 500,000 small steel consumers in every industry.

During the Chicago meeting, L. B. Worthington, U. S. Steel Supply Co., Chicago, was reelected to serve the warehousemen as chairman of the executive committee; and Walter S. Doxsey, Cleveland, was renamed as president and secretary of the Association.

Other officers elected for the coming year include Ben H. Knipe, Markle Steel Co., and Donald C. Lott, Fort Duquesne Steel Co. as vice-presidents; Paul O. Grammer, Grammer, Dempsey & Hudson, Inc. as treasurer.

Largest vertical boring and turning mill ever built in the United States has a maximum swing of 43 ft 5 in. with a table of 33 ft diameter. The machine is 65 ft long over crossrail and platforms, and its total height overall is 25 ft. The 1,250,000-lb mill, recently completed by Baldwin-Lima-Hamilton Corp., is being shipped to Officine Di Savigliano, Turin, Italy, where it is scheduled to be used primarily for turning parts for water power generators and turbines.



LATROBE MOVES

Latrobe Electric Steel Co. has announced the moving of its Chicago office and warehouse to recently built quarters at 2006 N. Hawthorne Ave., Melrose Park, Ill. They will continue to be under the direction of F. E. Allison, district manager.

METAL CARBIDES EXPAND

Metal Carbides Corp. announces an 8,000 square foot expansion of their plant at Youngstown, Ohio. Over $100,000 of new equipment, including electric furnaces, machine tools, powder mixing and crushing equipment, is scheduled for the addition.

Concentrated Conservation Saves Westinghouse $1,500,000

A program of note during this period of scarce materials particularly in the metals manufacturing and production of critical items, is that of scrap conservation carried on at Westinghouse Electric Company's Appliance Division and which has produced an estimated savings of $1,500,000 a year. The vital materials culled from the division's appliance producing lines includes copper, aluminum, brass, nickel and steel; some of it is reprocessed for further use; stamping methods are changed to stretch scarce steel; plating processes are improved to stretch copper and nickel supplies. Last year, the division's salvage department's operations recovered for further use in the production of appliances, more than 23,000 tons of steel and more than 815,000 pounds of non-ferrous metals.

Paper cartons which could not be returned to suppliers were cut, scored, wrapped with new paper and shaped into protective shipping pads—80,000 of them per month. Enough lumber to crate 3,300 refrigerators resulted from the recovery of 40,000 board feet. Over 160,000 gallons of paint was reprocessed and made suitable for many production operations through the use of water wash paint spray booths that collect excess paint.

Research and design engineers are constantly studying ways to conserve materials and have devised numerous plans for extending use of supplies now available. A typical example is the program, designed for conserving nickel used in plating processes, which suggests the use of synthetic organic finishes and bronze finishes instead of plating; the use of more available materials such as chromium and zinc instead of nickel plating; and the use of plastic instead of metal, where possible, in order to eliminate the requirements for nickel plating.

At the same time, the ingenuity of the men handling the production lines is capitalized on through the encouragement of suggestions. Through the company's suggestion plan, employees have reduced waste and scrap loss on many important items. Last year, the company accepted more than 31 percent of the suggestions received, and awarded to employees for their ideas a total of over $11,600.

REED ROLLED THREAD BUILD

Construction is under way on a new plant for the Reed Rolled Thread Die Co. at Worcester, Mass. Improved plant layout and added equipment is expected to enable the company to handle more efficiently. the demands for its equipment.

RESEARCHERS PROVIDE HOPE FOR METALMEN WITH TIN-SAVING SOLDER ALLOYS

In the light of present political uncertainty concerning controls affecting much of our sources of tin supplies, increased significance may be placed on the development of a group of solders which are said to permit extensive savings in tin normally used.

In research devoted to the project, results indicated that silver was the only metal readily available in volume that can be satisfactorily substituted for part of the tin in solder. There is little loss in working efficiency and cost is less than that of the alloys they are designed to replace, according to studies released by the recently formed Metals Conservation Committe of Federated Metals Division, American Smelting and Refining Company.

The tin-conserving solders are basically silver-tin-lead alloys as compared with the usual tin-lead variety. The addition of a small percentage of silver permits a marked reduction in the tin content. This solder group is an outgrowth of a similar series developed during World War II and which were proved through use in industrial operations.

In addition, the same fluxes and application means may be used as heretofore.

The Metals Conservation Committee has several projects scheduled to develop further ways of attaining its threefold objectives; to develop new alloys which either eliminate or drastically reduce use of critical non-ferrous metals; to investigate new applications for existing alloys to replace those requiring greater quantities of strategic metals; to recommend alternate alloys to meet requirements of various non-ferrous metal users.

KENNAMETAL GETS TUNGSTEN PROPERTY

The Nevada Scheelite Co., with mines and mill near Rawhide, Nevada, has been transferred by sale of stock to Kennametal Inc., producers of hard carbide metals. According to Philip M. McKenna, Kennametal's president, steps have been taken to improve output of this tungsten property under management of A. R. McGuire, mining engineer. It is believed that a 50 percent increase in output of 60 percent concentrates can be acieved, thus increasing U. S. supplies of tungsten.

rapidly duplicated with di-acro

HYDRA-POWER BENDER

An example of large radius forming.

At last—a PRODUCTION BENDER that "BENDS THEM ALL" — tubing — angle — channel—extrusions—moulding—strip stock—bus bars—and of course, all types of solid materials. U-Bolts and Eye-Bolts are just two examples of the shapes that can be rapidly produced in one operation with this hydraulic power bender.

The DI-ACRO HYDRA-POWER BENDER can be easily set up in your own plant for a great variety of forming operations, or it can be delivered completely tooled for speedy production of a specialized part. Investigate this universal machine before you buy any "single purpose" bender.

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giving full information on all DI-ACRO Benders, Brakes, Shears, Rod Parters, Notchers, Punches—also our offer of free DI-ACRO Engineering Service.

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O'NEIL-IRWIN MFG. CO.

375 8th Avenue, Lake City, Minnesota

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-6-85

North East West South IN INDUSTRY

Announcement of several appointments recently made at **Firth Sterling Steel & Carbide Corp.** included the naming of **W. P. Nolan** as chief engineer, **T. G. Barnes** as production manager, **J. T. O'Brien** as works manager of the steel division and **T. F. Nakles** as superintendent of maintenance.

Mr. Nolan joined Firth Sterling in 1941 as electrical engineer, later serving as superintendent of construction and maintenance until his present appointment. Mr. Barnes came to the company a year ago from Reynolds Alloy Co., where he was superintendent of the foil department. Mr. O'Brien was formerly associated with Carnegie-Illinois Steel Corp. where he was assistant superintendent of McDonald Mills before joining Firth Sterling in 1949; and Mr. Nakles, formerly was assistant superintendent of maintenance became associated with Firth Sterling in 1950.

Coming Meetings

June 14-16, symposium on surfaces, sponsored by Armour Research Foundation of Illinois Institute of Technology; Sheraton Hotel, Chicago.

June 11-14, Semi-annual meeting. **American Society of Mechanical Engineers;** Engineering Institute of Canada and Institute of Aeronautical Sciences also participating. Royal York Hotel, Toronto.

June 11-16, First National Congress of Applied Mechanics. Illinois Institute of Technology, Chicago.

Herman A. Bottenhorn has been appointed chief engineer of **Loewy Rolling Mill Div., Hydropress, Inc.** A graduate mechanical engineer, Mr. Bottenhorn is a specialist in design, development and manufacture of rolling mills for ferrous and non-ferrous industries. He has been a collaborator of Erwin Loewy, president of Loewy-Hydropress for more than 30 years.

Fred M. Gillies, executive vice-president of **Acme Steel Co.,** was elected to its board of directors at the company's annual stockholders' meeting. Works manager **William C. Fork** was elected vice-president at the board meeting which followed.

Mr. Gillies joined Acme in 1950 after 29 years with Inland Steel Co. A leave of absence in 1949 allowed him to accept appointment as production chief of the Allied Steel Commision in Germany.

Mr. Fork, oldest employee in terms of service, has been works manager of the Riverdale plant and a director of the company for the past two years. He joined Acme in 1908 as a handy man, rising consistently until he reached the position of superintendent of the hot mills, general superintendent and later works manager of the company.

William C. Fork

Curtis Franklin

Curtis Franklin recently was elected chairman of the board of directors of **Automatic Steel Products Inc.** Mr. Franklin, who has been secretary, treasurer and director of Automatic Steel, also holds the offices of secretary, treasurer those offices at The Cleveland Tapping Machine Co., a subsidiary of the corporation, and of the Rams-Head Co. He also is president and director of British Type Investors, Inc.

An addition to Automatic Steel's board of directors was made when **Ralph Henderson Everett** was elected a director for a term of three years. Mr. Everett has served as executive vice-president of the M. J. Merkin Paint Co., since 1943, while he earlier was associated with Keystone Varnish Co. as an officer.

OBITUARY

William T. Hunter, retired president of **A. Schrader's Son, Inc.,** and former vice-president of the **Scoville Manufacturing Co.,** died recently after 14 weeks illness. Mr. Hunter, who was 71 years old, had been associated with the Schrader concern for more than half a century at the time of his retirement in 1949. He remained as a director of the firm until his death.

IMMEDIATE DELIVERY

This Swedish tool and die filing machine represents the latest development in tool makers' and tool engineers' equipment. Users of this precision tool report tremendous savings in time and tool life, due to its high efficiency and accuracy. It is a necessity in tool and instrument making and will save countless hours of production time since carbide and hard metal tools can be sharpened without removal.

A few of Di-Profiles's advantages and uses:

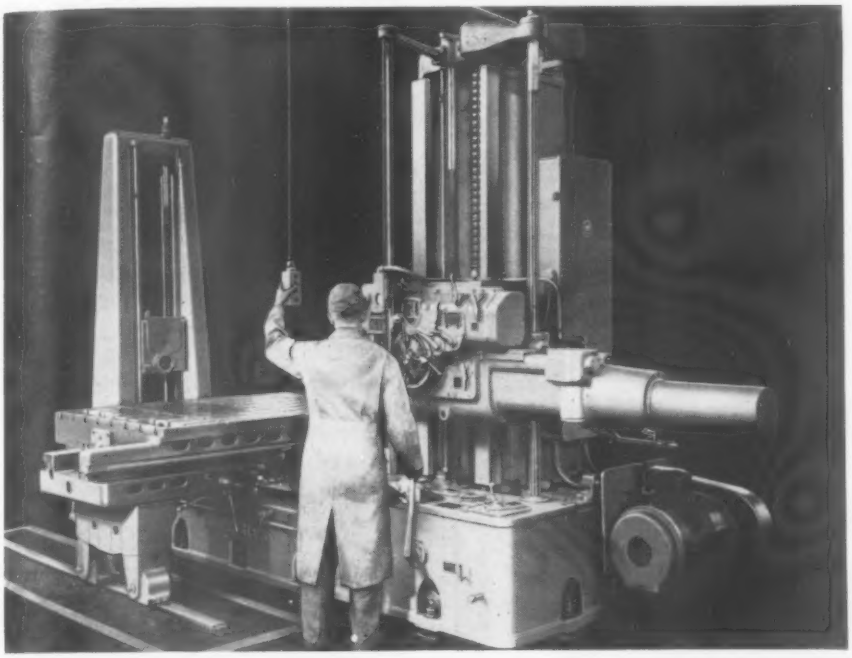
1. For filing, honing, polishing and lapping on inner and outer surfaces.
2. For sharpening all hard metal and carbide cutters and tips.
3. Attaches to a flexible shaft for other handwork, such as rotary drilling, sawing and filing.
4. Driven by any 10,000 rpm controllable speed electric motor.
5. Adjustable stroke from 0" to ¼".
6. Diamond files, needle files and circular diamond saws available or supplied as needed.

Nord INTERNATIONAL CORPORATION
50 CHURCH STREET, NEW YORK 7, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-86

Tools of Today . . .

High Speed Horizontal Boring Machine



Speeds from 10 to 1300 rpm in fine increments through 45 changes provide specific metal working advantages in a single-spindle, high-speed horizontal boring, drilling and milling machine by the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. The closer speed selection permits maximum machining efficiency when using cast-alloy and carbide-tipped cutting tools, and where they are not required the machine has capacity for all types of light, medium and heavy-duty machining within its size range.

Designed to meet urgent production requirements demanding fast cutting speeds together with greater accuracy, the machine incorporates hardened ways on bed and saddle which, in addition, are mounted to partially compensate for vibration created by adjacent machining.

The single spindle—4 in. in diameter—is of nitralloy steel and has a travel of 30 in. Rotating on anti-friction bearings, speeds up to 1300 rpm are possible to provide for milling, boring and sensitive drilling. Positive and automatic settings to close limits are provided by means of a quick-acting, electrically-operated positioning device. The predetermined settings of table and headstock are mechanically controlled without need of time-consuming final hand adjustments. A swiveling pendant control station, suspended from the top of the machine, can be swung in a semi-circle to any position within easy access for the operator. **T-6-871**

Fixture Components

Lodding Incorporated, Worcester 1, Mass., is prepared to furnish jig and fixture components such as cams, clamps and cam-clamp combinations, of which the assembly illustrated is but one of a large assortment.

A feature of these components is that the cams are made from 1-piece steel forgings, thereby providing maximum strength and extended life. Included in the line are quarter-turn screws, spherical washers and other items in standard sizes available from stock. **T-6-872**

Micro Hardness Tester

Kent Cliff Laboratories, Peekskill, N.Y. announce several major improvements in the Kentron Micro Hardness Tester used for making Knoop or Vickers hardness tests on metals, fine wire, small precision parts, plastics, glass, paint, ceramics, enamels and jewels, both natural and synthetic. The testing load range of this instrument has been considerably increased and now applies dead weight loads from 1 to 10,000 grams. The application of the dead weight loads is controlled by the precisely built oil dash pot with preloaded operating mechanism to eliminate backlash.

The mechanical stage is designed so that the test specimen slides underneath high powered objectives up to and including 1000X magnification without disturbing the original focusing of the microscope. The specimen always remains in focus from testing to viewing position.

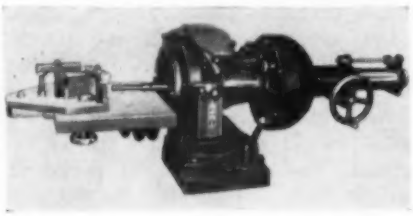
A redesigned specimen vise for holding mounted specimens fits into the mechanical stage. This vise is indexed so that, by aligning vise index with an index scribed on the specimen mounting and recording the micrometer readings of the X and Y axes on the stage, impressions can be located readily any time after the original testing. Frictionless leveling of the tester is now provided by three supporting pads which, when required, can be arranged for shock or vibration mounting.

Standard equipment includes triple objective metallurgical microscope of latest design; weights for applying 1 to 1000 grams; precise mechanical stage and calibrated reference blocks. Furnished as extra are the Knoop indenters, 136 deg diamond pyramid indenters, heavy weights for applying 1000 to 10,000 grams, and specimen vises. **T-6-873**

USE READER SERVICE CARD ON PAGE 99 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Hydraulic Boring Machine

Hydro-Borer announces precision horizontal hydraulic boring machines designed to meet work tolerances to ± 0.0003 in. and finishes to "aircraft"



specifications. Boring capacity is given as $\frac{5}{8}$ to $6\frac{1}{2}$ in. dia. and portability is emphasized in that these Hydro-Borer models weigh only 200 to 300 lbs.

Among the precision features stressed are: work is stationary and only the boring tool revolves; the surface to which the work fixtures mount is hand scraped to 0.0003 in. of square and at 90 deg to the spindle; and work-holding fixtures can be mounted on the face of the unit and precision finished on the machine itself.

Spindle drive is provided by a $\frac{1}{2}$ HP motor through V-belt to multiple pulleys, giving shaft speeds of 460, 900 and 1400 rpm. A novel hydro-mechanical feed provides maximum feed of 0.004 in. per revolution, and cutting tools may be adjusted from 0.0001 to 0.014 in.

The unit can be set to feed through work and remain in inactive position; feed to adjustable stops and return automatically; or continue in cycling operation, requiring only loading and unloading. Complete information may be had from Dept. A-58, Hydro-Borer Co., 1511 W. Florence, Inglewood, Calif. **T-6-881**

IN THE EYES OF AMERICAN INDUSTRY—

The Finest Circular Metal Cutting Tools Are CIRCLE Ⓡ !

—and because this is so, the demand for CIRCLE Ⓡ *products is at the highest peak in the history of the firm!*

Naturally, we want to give you the best possible delivery service, but current conditions oftentimes cause slight delays. These delays are due in part to slow steel deliveries and the sequence of priority orders taking precedence over non-priority orders . . . but *every* order has our best effort!

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INDIANAPOLIS • PITTSBURGH • PHILADELPHIA
PHOENIX • PROVIDENCE • ROCHESTER • ST. LOUIS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-88

Inside Micrometers

The L. S. Starrett Co., Athol, Mass., now offers tool users a choice of inside micrometers between the slim, solid rod type and the large-diameter, lightweight tubular rod type. Both tools feature "Satin Chrome Finish" which, making the markings stand out sharp and clear in any illumination, provides easy reading and a superior resistance to corrosion.

The No. 124 inside micrometers, with interchangeable solid rods approximately $\frac{5}{32}$ in. in diameter, are available in four models. No. 124A and 124B—2 to 8 in. with 6 rods, and 2 to 12 in. with 10 rods, respectively—have micrometer heads with $\frac{1}{2}$ in. movement and are supplied with a $\frac{1}{2}$ in. spacing gage. No. 124C—8 to 32 in.—has 4 rods, a 1 in. ring gage and two 2 in. gages, plus a micrometer head with 1 in. movement. Set No. 124D—2 to 32 in.—consists of the items in sets A and C.

The No. 823 series is available in two ranges; set A, $1\frac{1}{2}$ to 8 in.; set B, $1\frac{1}{2}$ to 12 in. These tools feature a $\frac{3}{8}$ in. rod of steel tubing, centerless ground, light yet rigid. Also featured is the minimum measuring capacity of $1\frac{1}{2}$ in. which permits use in small cylinders and restricted areas. The micrometer head has $\frac{1}{2}$ in. movement and rods may be attached to either end. **T-6-882**

Safety Matting

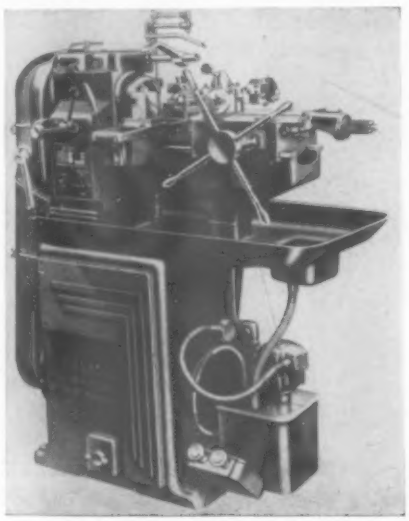
A rubber-and-cord type safety matting for industrial application, now being marketed under the name of Do-All matting, is designed to afford comfort and safety underfoot when used in front of machinery.

The matting comes in rolls 20 ft. 5 in. long, comprised of 35 x 35 in. units of four 17 in. square sections, and can be easily cut apart to obtain proper number of sections for each application. After cutting there is a beveled edge.

Four mottled colors are available: venetion red, erin green, delft blue, and mosaic. Full information available from the American Mat Corporation, 1790 Adams, Toledo 4, Ohio. **T-6-891**

High-speed Turret Lathe

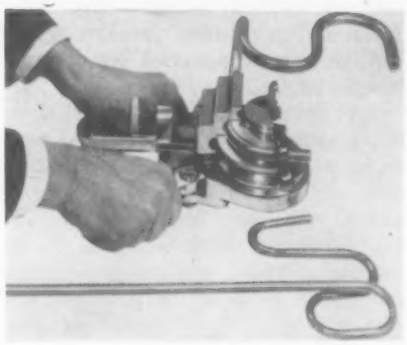
A stub turret lathe of rather novel design has been developed by Murad Development, Ltd., England. This is a ram-type machine of 1 i. collet capacity, built for heavy cutting and said to be held to 0.0005 in. tolerance on all critical dimensions.



Centralized grouping of control levers around an electrical control panel provides for easy operation. Two pedal-operated switches, at the right of the pedestal, control two motor speeds in 1:4 ratio. Six spindle speeds are available, forward and reverse. The spindle, running in pre-loaded ball bearings, has threaded nose and takes dead length collets.

A generously proportioned cross slide provides for heavy form cutting, and a micrometer adjustment in the rear tool post provides lateral adjustment to facilitate tool setting. Lubrication is automatic and coolant is delivered by a separate unit. Complete information available through British Industries Corp., International Machinery Div., 164 Duane St., New York 13, N.Y., Dept. MR. **T-6-892**

Midget Bender



Tal Bender, Inc., Milwaukee 2, Wis., announces a small yet powerful tool for making offsets and bends up to 180 deg in 3/8, 1/2 and 5/8 O.D. K & L copper tubing, brass, Bundy Weld, steel and other light-gage tubing.

Called the "3 in 1"—Model 1200—the tool requires no vise or fixtures as all three sizes are combined in the bender. Simple and fast to operate, and weighing only 5 lbs., the tool is especially suited to bending tubes used in refrigeration, radiant heat coils, aircraft manufacture, and other places copper or other light-gage tubing is to be bent. **T-6-893**

Grobet ROTARY FILES and TOOLS

THE COMPLETE LINE FOR EVERY INDUSTRIAL PURPOSE over 5000 shapes, sizes and cuts

GROBET Hand Cut, and Ground from Solid ROTARY FILES

1/8" SHANKS

1/4" SHANKS

1/8" SHANKS

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GROBET INSIDE TUBE-DEBURRING FILES

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GROBET High Speed Rasps

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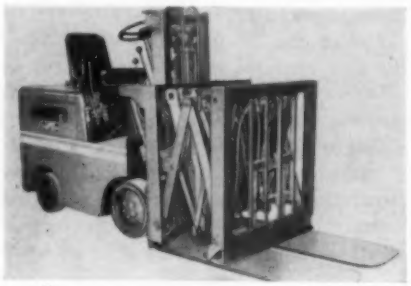
★ We invite you to send for Catalog HF2 of Grobet Swiss Files; Catalog HR2 of Grobet Rotary Files; Catalog F3 Grobet Rifflers; Catalog HB1 of Grobet Burs; Catalog HC of Grobet Countersinks.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-89

Pusher Fork Trucks

The Pul-Pac and pusher devices recently announced for Clark 3000 to 5000 lb. "Carloader" fork trucks are now available for both gas and electric 2000 lb. capacity Clipper lift trucks. Both devices feature pantograph-type linkage, a more powerful piston and a shorter stroke.



Unit loads, assembled on relatively inexpensive carrier sheets rather than on conventional pallets, can be pulled onto and pushed off the load-carrying plates with the Pul-Pac device. The Pusher device, which is similar except for the gripping mechanism and carrying-plate, is used for unloading operations only. Unit loads can be unloaded directly from the forks or from conventional pallets with the Pusher whenever rehandling as a unit is not required.

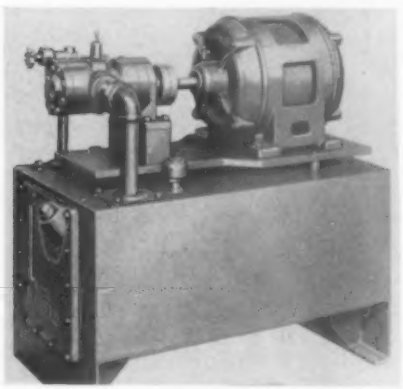
Both devices in the 2000 lb. size are now in production. Full information may be obtained on request to Clark Equipment Company, Industrial Truck Div., Battle Creek, Mich. **T-6-901**

"Automatic Secretary"

Announced by Electronic Secretary Distributors, Inc., 803 W. National Ave., Milwaukee 4, Wis., is the "Electronic Secretary," designed for absentee answering of a phone, taking down messages and even telling a caller the time of return. In case of an emergency, a caller can be told where his party can be reached. The unit is not connected to the phone; instead, is merely plugged in and, as stated by the maker, may also be used as a portable dictating machine. **T-6-902**

Hydraulic Power Units

Vickers Incorporated, 1416 Oakman Boulevard, Detroit 32, Mich., announces a line of hydraulic power units constructed in entire accordance with recommended JIC Hydraulic Standards for Industrial Equipment.



Features include a completely sealed tank, with breather air cleaner and separate filler hole having removable mesh screen and chain-attached cap; elevated tank body with dished bottom, drain plug, and clean-out holes at both ends to permit drainage without spillage and complete cleaning of the tank; and flush type oil level indicator with high and low oil positions marked. Motor mounting plate is separate from tank for convenience in mounting the units.

The units are available in three series: T20, T30 and T60, and in 10 models for electric motors from ¾ to 25 hp. Vickers single, double and two-pressure pumps are used for 1000 psi service, Vickers two-stage pumps for 2000 psi service. Supplementary Sheet 12a, available on request, gives tabulated engineering data. **T-6-903**

MEMO
Tom- Please specify Micro-Metric Machined "Detroit" die sets.
J.S.
CALL "DETROIT"
DETROIT . . . . TR 2-5150
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DAYTON . . . . HE 3042
GLEN RIDGE, N. J. . GL 2-5658
INDIANAPOLIS . . HU 5604
LOS ANGELES . . AD 7251
MILWAUKEE . . . GL 3-7170
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PITTSBURGH . Perrysville 4-5111
ROCK ISLAND, ILL. . R.I. 8-2814
ST. LOUIS . . . . FR 6811
ST. PAUL . . . . CE 1600
SAN FRANCISCO . . EX 2-7018
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"DETROIT" standard die sets are Micro-metric jig-bored and machined to exceptionally close limits of parallelism, flatness and squareness with the guide-pin axis. This precision reduces strain warping, and results in longer die life and long, uninterrupted production runs. Order from your "DETROIT" representative.
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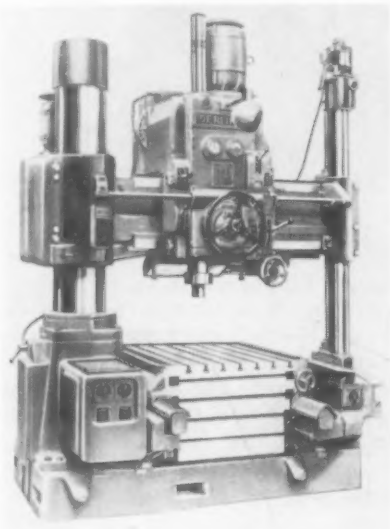
2895 W. GRAND BLVD. • DETROIT 2, MICHIGAN
DETROIT DIE SET ★

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-90

Production Jig Borers

The Cosa Corporation, 405 Lexington Ave., New York 17, N. Y., is introducing in the United States two Oerlikon production jig borers—Types R-2 and R-3—for precision and production boring, drilling, reaming, tapping, screw cutting, facing and outside turning without jigs.

These double column machines are designed so that the boring head, cross rail and smaller column can be locked rigidly in any position. The rigid frame thus created is said to make it possible to locate holes by the coordinate method, using gage blocks or pins, to a claimed tolerance of 0.0004 to 0.0008 in. between centers and to drill holes as small as 0.040 in. in diameter.



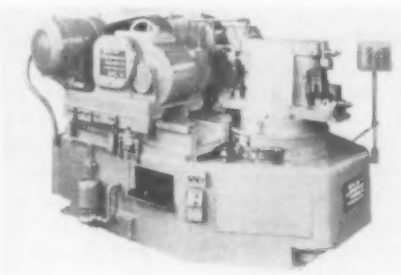
Both models have 18 spindle speeds and 12 feeds—the R-2 from 38 to 1900 rpm and feeds from 0.0012 to 0.031 in. per rev., the R-3 from 30 to 1500 rpm—and feeds from 0.0012 to 0.0472 in. per rev. The motor on the boring head of the model R-2 is 6 hp; of the model R-3, 7.5 hp.

The smaller column at the extreme end of the cross rail rides easily over a wide arc and, with head and arm, is locked rigidly by electro magnets controlled by a single switch. They can also be mechanically locked or released independently of each other. Additional design features include: a fast mechanical return of spindle in addition to hand operation; an automatic feed for setting depth of holes up to 14½ in.; a tool-ejector bar inside the boring spindle; graduated precision scales with vernier readings to 0.0008 in. on ways of boring slide and work table. All operating controls are conveniently located on the boring head. **T-6-911**

USE READER SERVICE CARD ON PAGE 99 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Duplex Miller

The Motch & Merryweather Machinery Co., 715 Penton Bldg., Cleveland 13, Ohio, announces a duplex milling



2-station machine for face milling. A rotary indexing table carries two sets of work-holding fixtures mounted on an index head. While one fixture is at the work station the operator unloads and loads the open fixture.

The two opposed milling heads traverse forward, feed to an adjustable stop and rapid traverse return. Utilizing up to 30 hp, the milling heads have up to 2 in. of lateral adjustment to allow for tool setting and to compensate for cutter wear. The milling heads and lathe index are hydraulically actuated and lubrication of all parts is automatic.

T-6-912

New **'HABIT'** Diamond Tool
Does More Work Better for Less

The **'HABIT'** Index-A-Point has been designed to provide a simple and foolproof method of rotating a diamond through a sequence of seven stations mechanically positioned to present a keen, sharp edge or point to the grinding wheel at each station.

'HABIT' *improves grinding finishes.*

'HABIT' *diminishes diamond consumption more than 30%.*

'HABIT' *reduces diamond re-setting to as little as 1/10th.*

'HABIT' *increases productivity.*

Get the **'HABIT'** Index-a-Point Abrasive Tool Dresser...

Informative literature will be sent on request.

U. S. Patent applied for

EST. 1908 **ANTON SMIT & Co., Inc.**

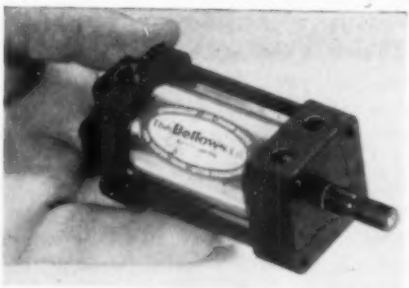
333 W. 52nd St., New York 19, N. Y. Cables: PROFITABLE, New York

IMPORTERS OF INDUSTRIAL DIAMONDS, MANUFACTURERS OF DIAMOND PRODUCTS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-91

Small Air Cylinder

A 1⅛ in. bore, 1 in. stroke, single-acting, spring return small air cylinder,

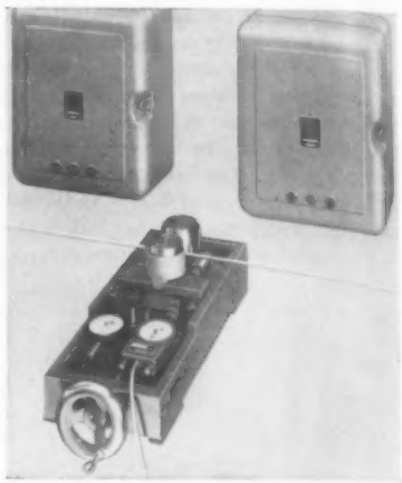


added to the line of "Controlled-Air-Power" devices by The Bellows Company, Akron 9, Ohio, was developed primarily for use in jig and fixture operations and for parts positioning and ejection. Trade-named the Han-D-Air Cylinder, it has a power factor of 1:1, developing a thrust approximately equal to the applied air pressure.

Compact in design—4½ in. long by 1½ in. high by 1½ in. wide—the cylinder can be mounted in practically any position: front flange, rear flange, side, foot, or front pivot. The 5/16 in. diameter piston rod has ½ in. of threaded end to simplify installation.

While simple in design, construction is said to be unusually sturdy: heavy gage pump finish brass cylinder, ⅝ in. thick aluminum alloy heads, oil resistant piston cup, and a heavy tension-tested spring are all conducive to life and performance. **T-6-921**

A Correction



Over T-4-662—Continuous Wire Measuring Gage, by Federal Products Corp., Providence, R.I.—we inadvertently used a photograph of the Federal Model 144-B-12 automatic sorting gage instead of the correct illustration, which is here shown. The gage, which measures and controls the thickness of material—such as insulations—extruded on bare wire, saves material and provides full visibility of the wire at all times. **T-6-922**

Spiral-Pointed Tap

A short-flute, spiral-pointed tap, especially designed to reduce breakage on certain tapping and retapping operations, has been added to the regular line of Bay State Taps by the Bay State Tap & Die Co., Mansfield, Mass. This tap has spiral flutes extending a short distance from the point to provide extra strength at the point of greatest strain. This is said to be a major improvement for automotive assembly line tapping where extreme misalignment is sometimes unavoidable.

A combination of rigidity plus cutting efficiency is said to make these taps outstanding for certain applications such as tapping through holes in sheet metal and thin sections where the length of thread does not exceed one diameter. They are available in high speed, ground thread fractional and machine screw sizes as listed in Supplement A to Bay State Catalog No. 49.

T-6-923

USE READER SERVICE CARD ON PAGE 99 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

ARMSTRONG
TOOL HOLDERS
for every operation!

There are ARMSTRONG TOOL HOLDERS in sizes and types for every operation on lathes, planers, slotters and shapers—for the heaviest cuts; for the most delicate cuts. With Standard shaped cutters, bits and blades of ARMSTRONG HIGH SPEED, ARMALOY (Cast Alloy) and ARMIDE (Carbide-Tipped) they provide a system of tooling that assures maximum production per machine hour, lower tool costs, and higher machining profits.

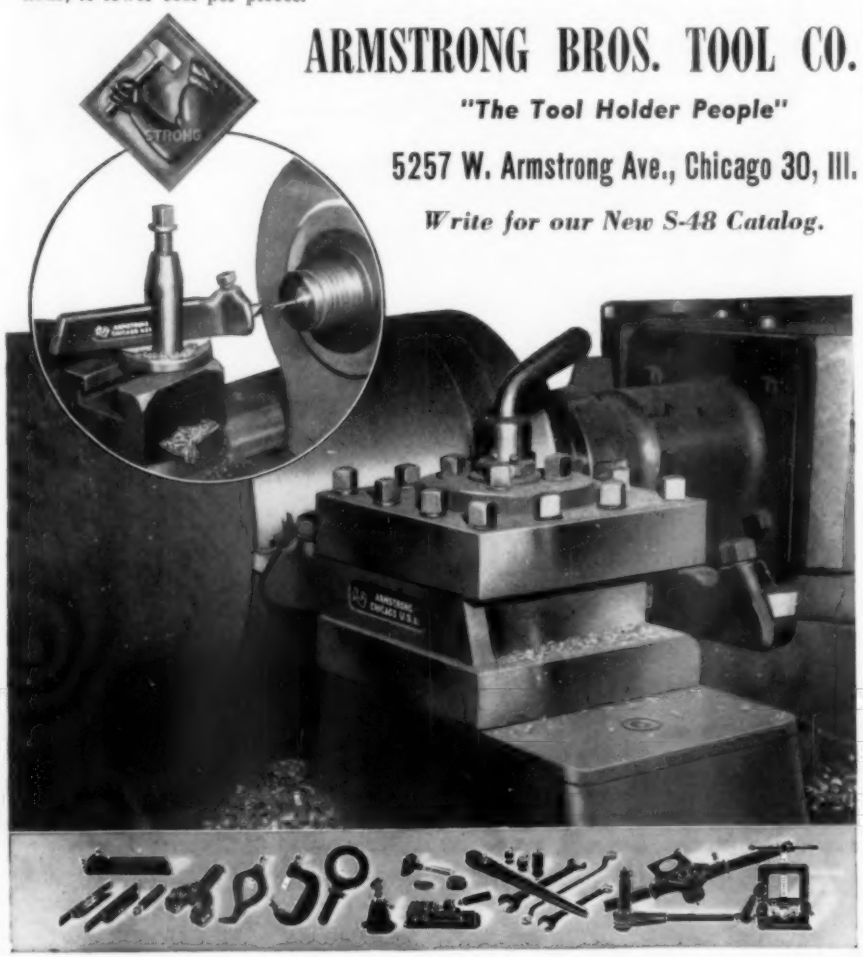
These permanent multi-purpose tools can be picked up as needed from your industrial distributor. Use them wherever possible to increase number of pieces per hour, to lower cost per pieces.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5257 W. Armstrong Ave., Chicago 30, Ill.

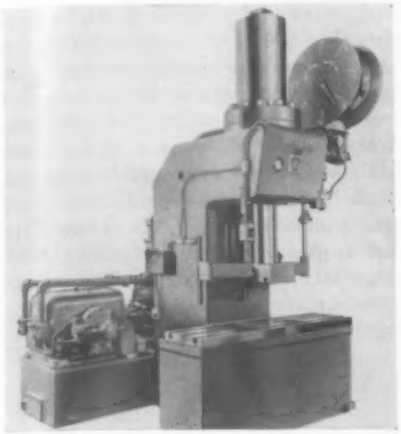
Write for our New S-48 Catalog.



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-92

Straightening Press

Integral joint steel casings and tubing, in sizes 2⅜ to 10¾ in. O.D. and having a yield strength up to 125,000 psi may be squeeze-straightened in anvils on a special 200-ton gag press developed by the Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.



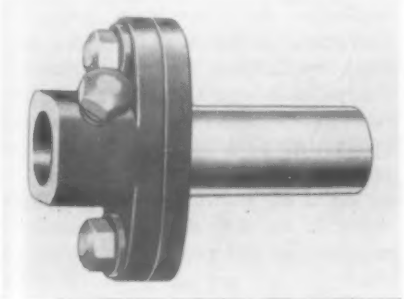
This press has semi-automatic push-button control, independently variable press and return speeds, and selection of high down speeds at half tonnage. Salient features of the press is a 12 x 16 in. ram nose and a 72 in. long table with dual T-slots.

Power is supplied by an Oilgear DX-15025 2-way variable delivery pump directly connected to a 125 hp, 1500 rpm electric motor through a speed reducer. When set for 4 in. ram travel, the press provides up to 30 cycles at half tonnage and up to 21 cycles at full tonnage.

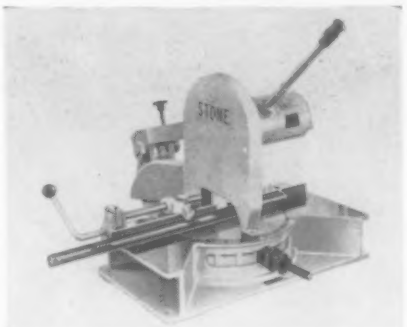
General specifications: stroke 20 in.; daylight 35¼ in.; throat 12 in.; table height 36. Maximum ram speed down, at full tonnage is 188 ipm; at half tonnage, 393 ipm; maximum speed up to 362 ipm. Floor space 128 x 112 in.; net weight, 37,000 lbs. **T-6-931**

Floating Holder

Announced by the Canfield Screw Machine Co., Stratford, Conn., is the No. 00 floating holder, a non-releasing type, low-cost tap holder designed for use on screw machines and turret lathes. Hardened and highly polished to provide long life, the tool is designed for maximum accuracy. **T-6-932**



Metal Cut-off Machine



A metal cut-off machine, designed to perform low-cost cutting of ferrous and non-ferrous metals at the rate of 4 seconds per square inch, is now in production. The capacity of this machine is 1½ in. solids, 2½ in. pipe and structurals, and miscellaneous cutting of 2 in. solids. A semi-high speed saw blade is recommended for the cutting of non-ferrous solids up to 1 in., and light wall tubing, structurals, and extrusions up to 2½ in.

For further information write Stone Machinery Co., Inc., 651 Fayette St., Manlius, N. Y. **T-6-933**

Cylindrical Die Thread Rollers

For Precision Threading
Knurling — Forming
Burnishing — Serrating

Thread rolling saves expensive material at a time when it is not only at a premium but difficult to obtain. This is particularly true on headed parts, metal stampings and long or short bars partly threaded or threaded their entire length.

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Manufacturers of
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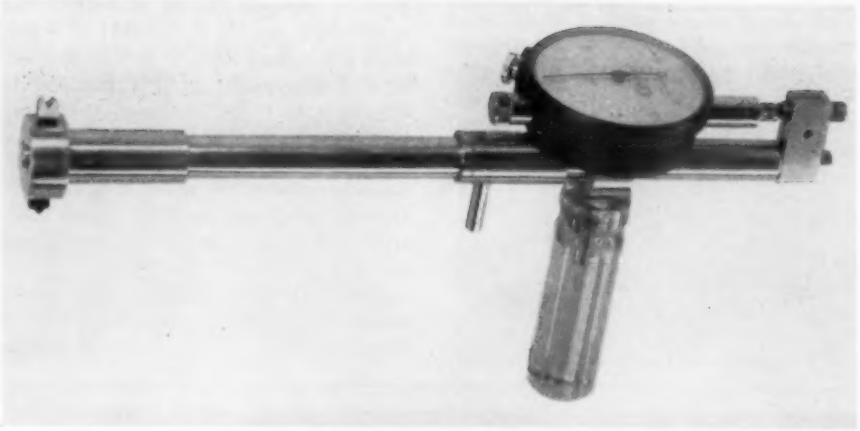
Worcester 2, Massachusetts, U. S. A.

TE-021

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-93

Thread Comparator



The Rimat Machine Tool Co., 1117 Air Way, Glendale 1, Calif., has developed an internal thread comparator that measures from the pitch line of any one thread in a "nut" to the pitch line of the two threads lying diametrically opposite. When set to a basic ring gage, the comparator gives plus or minus deviations from the basic pitch. The indicator reading is in "tenths", and for any one setting the instrument has a range of plus or minus 0.003 in.

The comparator is portable, so may be used equally well at the machine or at the bench. Only nominal operator skill is required in its use, and threads in deep holes are measured as readily as those located near the mouth of an opening.

The instrument may be readily set to a ring gage. This setting automatically compensates for any wear of the gage members which contact the work piece; therefore, the instrument need not be replaced or reconditioned frequently to maintain original accuracy. Standard instruments are available for measuring NC threads ½ in.—13 to 4 in.—4, and NF threads from ½ in.—20 to 1½ in.

T-6-941

The Hassall
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better... quicker... at less cost

If your assembly requires a threaded pin for use in either metal or plastic, call on Hassall. We can offer you substantial savings in costs and prompt delivery even on small orders.

Size range: diameters 1/32" to 1/8"—lengths to 1". These threaded pins can be produced with threads, knurls and with either straight or spiral flutes.

If your problem involves a hinge pin, an insert or a small threaded pin for some other purpose, we can supply it in a wide variety of metals and in suitable plated finishes.

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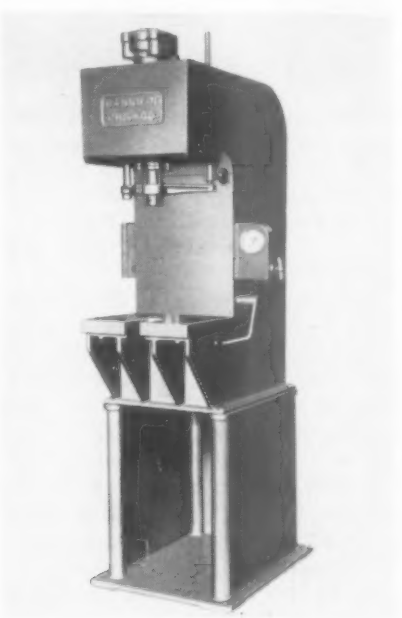
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-94

Hannifin Adds Presses

With the addition of 5-ton and 8-ton hydraulic presses, Hannifin Corp., 1120 So. Kilbourn Ave., Chicago 24, Ill., now offers a complete line of small hydraulic presses in ranges I to 10 tons—all in addition to the companys' line of 75 standardized presses in capacities up to 150 tons.

Like the other small Hannifin presses, they are in continual quantity production and can usually be supplied on shorter notice, and at lower cost, than presses built to order. Of interest is the speed of the presses, and the fact they are offered as complete units with built-in reservoir and with motor and pump mounted inside the frame. Typical applications include forming, bending, trimming, staking, riveting, and press-fit assembly work.



Designated as the F-50A and the F-80—5 and 8-ton—they are also offered with larger motor and pump and consequently higher ram speeds as the F-51 and F-81, respectively. Still higher ram speeds can be furnished when needed. Single manual lever control—handle down, ram down; handle released, ram up—is standard, but dual manual levers and electric push button control are both available.

Another feature that is particularly desirable for repetitive production operations is that stroke can be shortened, by limiting the return stroke to the point where the ram just clears the work. Thus neither ram motion nor productive time is wasted; also, the actual force exerted by the press can be adjusted anywhere in a range between 10 and 100 percent of maximum capacity, so the press will deliver the exact pressure needed. **T-6-942**

Behr-Manning Offers New Masking Tapes

Behr-Manning Corp., Troy, N.Y.—Division of Norton Co.—now offers for industrial application a line of paper-backed, pressure-sensitive tapes under the trade name BEHR-CAT Brand Masking Tapes. As claimed by the manufacturer, this is a superior tape designed for a wide variety of masking applications such as in spray or brush painting; stenciling; packaging; sealing; holding, as for loose parts in assembly; labeling, as on goods transferred from original containers; and surface protection, as glass from chipping and equipment in transit.

Correct tackiness for faster application, better flexing to contours, dead-stretch that prevents creep-under of paint, thinness that prevents build-up of paint, ideal performance in high temperature work, better balance between tensile strength lenghtwise and tear strength crosswise, and "no resideu" strip-off in unmasking, are among the quality benefits claimed by Behr-Manning. The tapes are available in standard length rolls of all popular widths, boxed or bulk packed. **T-6-951**

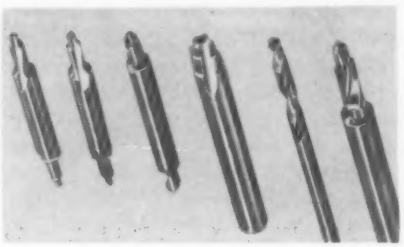
Explosion-Proof Solenoid

An explosion-proof solenoid housing for use on Ross electrically operated pilot controlled valves has been announced by Ross Operating Valve Company, 120 East Golden Gate, Detroit 3, Mich. The cover, which can be used wherever fire and explosion hazards exist, is manufactured of cast-aluminum to Underwriters' Laboratory specifications, Class I, Group D, Air Break Type.

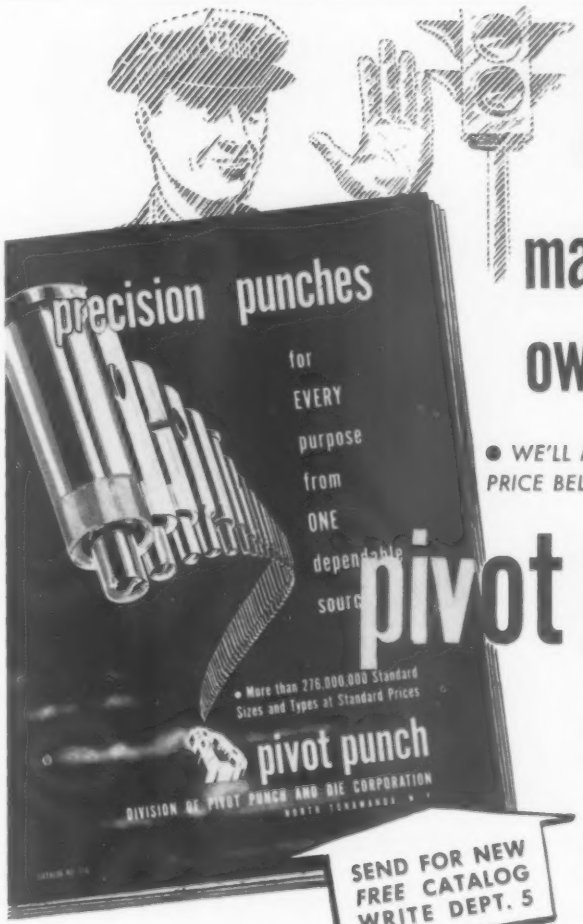
Provision is made for standard conduit connection. The explosion-proof solenoid cover may be used with ¼ to 1¼ in. size Ross pilot operated straight-way, 3-way, 4-way and 4-way five-port models for single solenoid operation. This housing may also be used for double solenoid, momentary operation of Ross base-mounted pilot controlled valves. **T-6-952**

C'bores and Step Drills

High-precision small counterbores and step drills are now available through Woodruff & Stokes, Inc., 349 Lincoln St., Hingham, Mass. Made of carbon or high-speed steel, or special steel alloys, these W-S tools are said to make possible worthwhile savings through longer tool life and improved performance.



These tools have tolerances of 0.0002 in. on diameter and 0.0003 in. on eccentricity and may be used on a variety of precision machining operations. These include straight and angle shoulder; cutting and non-cutting pilot; single and double ended; from 2 to 5 cutting diameters; and straight and spiral flute. **T-6-953**



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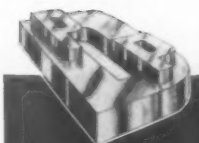
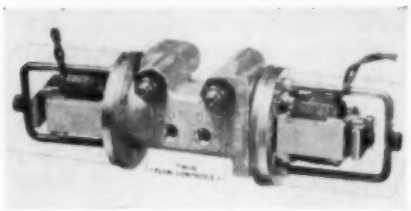


pivot punch
DIVISION OF PIVOT PUNCH AND DIE CORPORATION
NORTH TONAWANDA, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-95

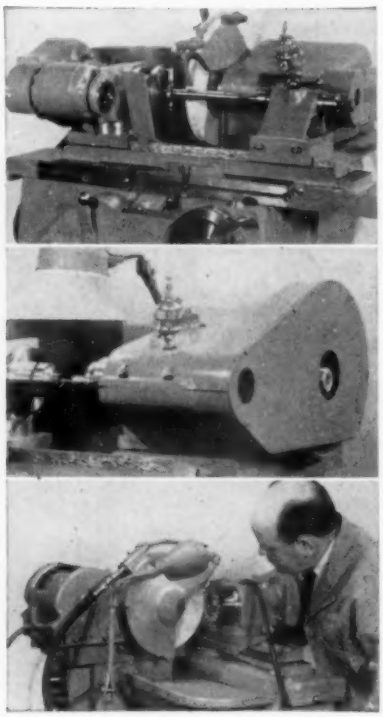
Double Solenoid Valve

A corrosion-resistant, double-operated solenoid valve for air and low pressure hydraulic cylinders is announced by Airmatic Valve, Inc., 1643 E. 40th St., Cleveland, Ohio. Called the DDS-4-375, this model is for operation of double-acting air and low pressure hydraulic cylinders where pressure must be held on one side of the cylinder for a given period of time. Also featured are built-in flow controls to govern speed of cylinder.



The valve may be reversed by momentarily energizing a single solenoid and the cylinder may be held in position without the necessity of holding either solenoid energized. As a safety feature incorporated in the design, power failure will not reverse the valve or cylinder. Available in ¼, ⅜ and ½ in. full orifice area in two styles of mounting, the valve may be base-mounted or pipe mounted directly to the body.

T-6-961



ARTER

MODEL No. 103

A relatively low-priced machine for cylindrical, internal, end or surface grinding.

The ARTER Model No. 103 grinder can be purchased as a combination machine for the classes of work illustrated, or it can be purchased just for cylindrical jobs, or for internal work. Many of these machines are being used for tool room work or as auxiliary equipment to take the overload of higher priced machines.

Capacities: With internal head—⅛" to 3" dia. x 4" long. With external head—3" dia. x 10" long. Swing over table 9".

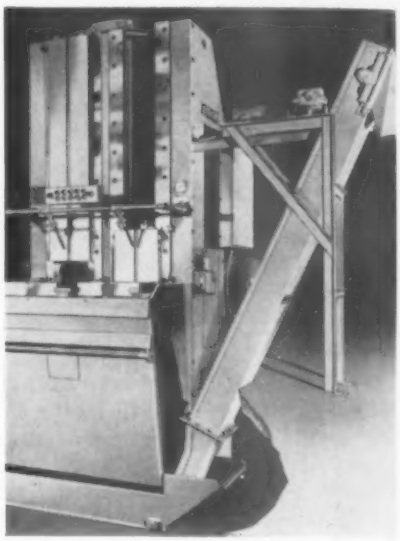
ARTER GRINDING MACHINE CO.

WORCESTER, MASSACHUSETTS • U. S. A.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-96

Automatic Chip Conveyor

The Type XD-30x66 in. stroke double slide vertical surface broaching machines, by The Oilgear Company, 1585A W. Pierce St., Milwaukee 4, Wis., may now be equipped with automatic chip conveyors. All chips are automatically removed from each machine base by a General Conveyors Corporation, continuous-type conveyor driven by a 1 hp, 1200 rpm electric motor and speed reducer. Chips are carried to a hopper on the floor level.



The centrally located control of the broaching machine includes dual safety start buttons; a selector switch for manual, semi-automatic or full-automatic operation; a hand lockout and pushbuttons for inching tables and slides and for starting and stopping conveyor; cutting fluid pump; and Oilgear two-way variable delivery pump.

T-6-962

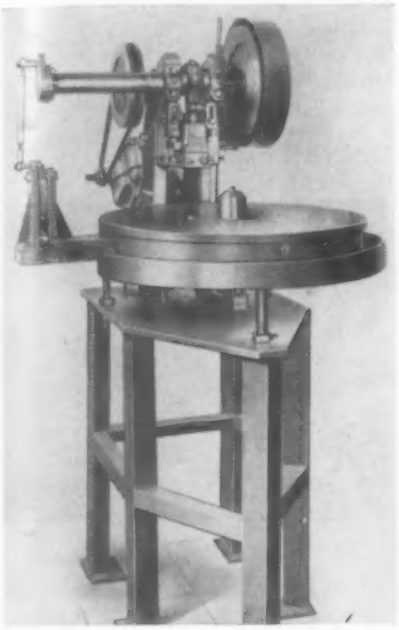
Tool Bits by Gorham

Three distinctive tool bit materials, developed to meet various metal-working applications, have been developed by Gorham Tool Co., 14400 Woodrow Wilson Ave., Detroit 3, Mich. Available from stock in standard sizes for immediate delivery, these ground bits and turning tools may be had in the following materials:

Gorham "Standard", for the commercial field; "M-40-B", a super-moly grade for heavy turning; and "Gormet", for turning soft or abrasive stock at high speeds. Ground cut-off blades, in 17 stock sizes, are also available in the Standard material. All fully described in Gorham folder A-76, available on request. **T-6-963**

Dial Feed Presses

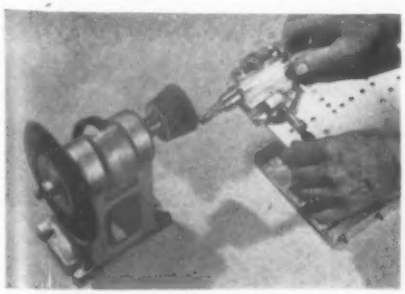
O. F. de Castro & Associates, 1517 Santa Fe Ave., Los Angeles, Calif., announces a Speedex 5-ton back geared O.B.I. dial feed punch press as an addition to their line of Speedex dial index feeds.



Solidly constructed throughout and incorporating a heavy semi-steel frame, this press is available in either 1 or 2 in. stroke. The dial feed is mounted directly on the frame and connected to the crankshaft by means of an adjustable rod with an eccentric drive. Timed by rotating a cam on the crankshaft, the index feed is said to be positive in action and accurate to 0.0002 in. The presses can be furnished with 12, 15 or 24 in. diameter index feeds. **T-6-971**

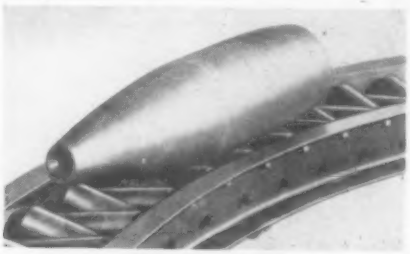
Tool Sharpener

A tool sharpening attachment for use with the Treyco sharpening fixture, by Treyco Products, 264 Hartford Ave., Kenmore 23, N. Y., provides easier, faster and greater precision in sharpening of end mills, spotfacers, routers and similar cutting tools, carbide-tipped included. Included with each attachment are 3/16, ¼, ⅜ and ½ in. sleeve adapters for various tool shanks. An index sleeve for No. 2 Morse taper is available. **T-6-972**

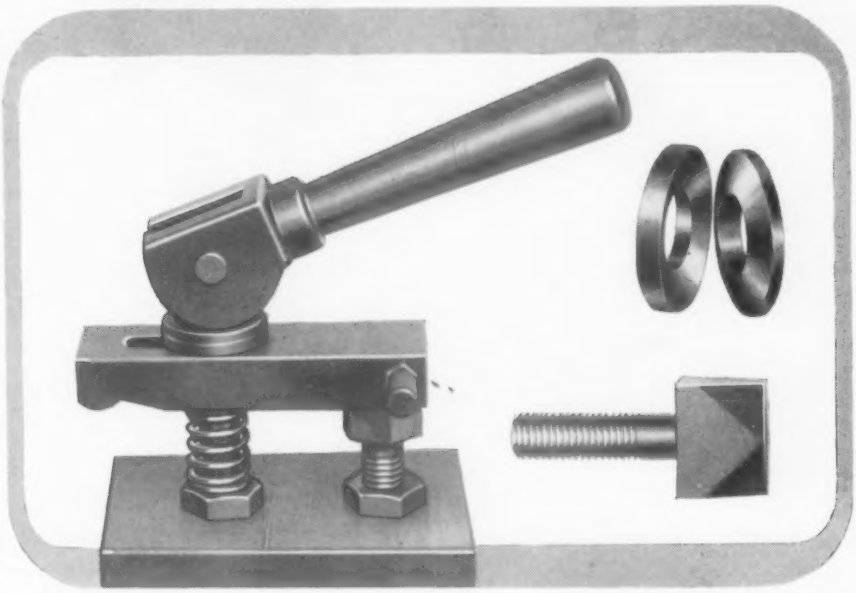


Gravity Conveyor

A specialized war-time adaptation of gravity roller conveyors by the Lamson Corporation, Syracuse, N. Y., arranges conveyor rollers to form a wide "V" to cradle cases and projectiles for safer, speedier and easier handling. The V-type gravity conveyor is made for quick shipment in standard ten foot straight sections and 90 deg. curves.



Projectiles can be taken off the conveyor by rolling them over the conveyor guard rail, thus eliminating lifting operations. Rollers are easily snapped out and reversed should they become worn in one area. The conveyor sections may also be used to convey non-military cylindrical-shaped products without alteration, or can be readily converted for handling of normal peacetime products. **T-6-973**



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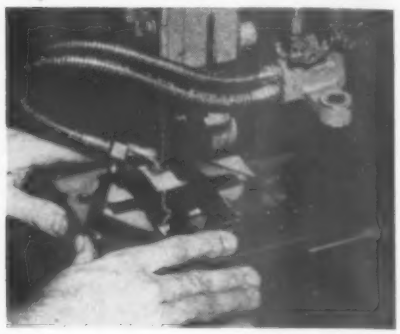
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-98

"Line Grind Band"

The DoAll Company, Des Plaines, Ill., has introduced the "Line Grind Band", a tough alloy band onto which cubical molded abrasive matrices are welded to provide a continuous grinding band. Used with a DoAll Contourmatic band machine, it permits precision "vertical grinding" on inside, outside and contour cuts in hardened metals. Its cutting action equalizes balance between bonding and abrasive grits to give a constant degree of abrasive exposure.



The band is manufactured in two types and two grit sizes to provide a complete selection for cutting and grinding various materials. One band, made of aluminum oxide, is recommended for grinding heat-treated and heat-resistant alloy steels and wear-resistant non-ferrous alloys. The other, of silicon carbide, is recommended for grinding and cutting of geological, silicified and vitrified materials such as glass, quartz, marble, granite and ceramics.

Also announced by DoAll is a power feed now available as an optional feature on their light-duty 16 in. throat band machine. This is the same type of automatic power feed that is standard equipment on their heavy-duty toolroom band machine and relieves the operator of pushing the workpiece into the saw band. Further information on these interesting developments may be had from the manufacturer. **T-6-23**

Threading Calculator

A simple, practical slide rule designed to facilitate estimations of threading time on the Cri-Dan single-point semi-automatic high speed threading machine is now available from the Lees-Bradner Co., Cleveland 11, Ohio.

This calculator is said to be of particular value in estimating threading time within the Cri-Dan's broad range of threading operations, all performed with a single-point carbide or high speed steel tool.

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

LITERATURE NUMBER	COMPANY	BULLETIN	DESCRIPTION
A-6-156	ADAMAS CARBIDE CORPORATION		Revised "Carbide Manufacturers' Grade Recommendations" shows grade suggestions of all carbide manufacturers.
A-6-14	ALLEGHENY LUDLUM STEEL CORP.		"Cutting Tool Materials" analyzes and compares types as well as covering grade selection, etc.
A-6-116	AMERICAN BROACH & MACHINE CO.	No. 300	Circular discusses American vertical hydraulic surface broaching machines.
A-6-92	ARMSTRONG BROS. TOOL CO.	S-48	Covers company's tool holders for every operation.
A-6-124	THE ATRAX CO.		Complete catalog of company's ground-from-solid tungsten carbide rotary files, end mills, reamers, drills, etc.
A-6-160-4	W. O. BARNES CO., INC.		Band saw folder on company's line.
A-6-19	BENDIX WESTINGHOUSE AUTOMOTIVE AIRBRAKE CO.		"Robotair—the Industrial Air Control of a Thousand Uses" stresses time, money and effort savings.
A-6-133	CHARLES H. BESLY & CO.		Valuable up-to-date information on modern grinding abrasives in "Besly-Titan Wheels" booklet.
A-6-163-2	CHICAGO RIVET & MACHINE CO.		Rivets catalog contains engineering information and rivet specifications plus illustrated descriptions.
A-6-122	CINCINNATI LATHE & TOOL CO.	CO-15	Describes special features, advantages and specifications of company's Royal Radial for drilling needs.
A-6-8	THE CINCINNATI SHAPER CO.	S-5	Covers full line of Cincinnati shears.
A-6-134	CRUCIBLE STEEL COMPANY OF AMERICA		Tool Steel Selector aids in choosing proper steel for particular use.
A-6-89	GROBET FILE CO. OF AMERICA, INC.	HF2, HR2 F3, HB1, HC	Catalogs cover company's lines of Swiss files; rotary files; rifflers; burs, and countersinks.
A-6-16	HANNIFIN CORP.	No. 150	"Hy-Power Hydraulics" emphasizes strength, economy, precision of Hannifin riveting equipment.
A-6-3	HARDINGE BROTHERS, INC.	Bulletin 8	Complete information in Hardinge-Sjogren chucks and collets.
A-6-119	JONES & LAMSON MACHINE CO.		Catalog covers J&L tangent chaser die heads.
A-6-108	KENNAMETAL, INC.		"Performance Reports", issued semi-monthly, contain information obtained by field engineers on methods and tooling used in numerous shops.
A-6-2	LANDIS MACHINE CO.	F-80, F-90	Bulletin on Landmatic die heads—stressing economies.
A-6-143	THE LAPOINTE MACHINE TOOL CO.	HP-5	Contains engineering and complete specifications of company's series horizontal broaching machines.
A-6-158-2	W. F. MEYERS CO., INC.	No. 13	Data and prices included in bushing catalog.
A-6-123	MILLER MOTOR CO.	B-200	Full details concerning Miller fluid pressure boosters.
A-6-155-2	NEW HERMES, INC.	H-41, IM-41	Catalogs describe heavy duty engravograph and portable engravograph.
A-6-164	NORTON CO.	No. 1306	Price and other information concerning ceramic surface plates.
A-6-144-1	OAKITE PRODUCTS, INC.		Twenty-four page illustrated booklet stress ease and economy of use of two types solvent detergents for metal cleaning.
A-6-85	O'NEIL-IRWIN MFG. CO.		Forty-page "Die-Less Duplicating" catalog covers line of benders, brake, shears, rod parters, notchers, punches.
A-6-95	PIVOT PUNCH AND DIE CORP.		"Precision Punches for Every Purpose from One Dependable Source".
A-6-135	SCULLY-JONES AND CO.	No. 8-50	Shows complete range of sizes, specifications and prices of "JA" floating holders for drilling, reaming and tapping.
A-6-5	STANDARD GAGE CO., INC.	B	Advantages and special features of line in "Standard Gages".
A-6-163	SUPER TOOL CO.	No. 50	Discusses line of carbide tipped reamers.
A-6-154-5	THE VAN KEUREN CO.	No. 34	Catalog and handbook on plug gages represents two years of research.
A-6-146	VERSA-MIL CO.	No. 6	Illustrates solving many machining problems, stressing economy.
A-6-110	S. B. WHISTLER & SONS, INC.		Cost-cutting advantages discussed as shown in various plant installations and operations.
A-6-112	WIEDEMANN MACHINE CO.	No. 241	Describes method of producing chassis and similar work in short and semi-production runs emphasizing efficiency.

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THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Die Cushions

Widely illustrated 20-page brochure deals with line of pneumatic and hydropneumatic die cushions for mechanical presses; series of cushion charts covering wide range of sizes and types are further explained through photographic illustrations accompanied by engineering drawings. **Danly Machine Specialties, Inc.,** 2100 South Laramie Ave., Chicago 50. **L-6-1.**

Cutting, Grinding

"Cutting and Grinding Facts" presents data concerning more than 50 typical metalworking jobs in 80-page edition. Operation data based on late information supplied by leading builders of equipment; practical charts show correct cutting fluids for more frequently used metals and metalworking machines. **Sun Oil Co.,** 1608 Walnut St., Philadelphia 3. **L-6-2**

Marking

"Job-indexed" catalog of marking devices facilitates selection of most suitable holder for given application by displaying all standard holders for particular class of work (on machines or manually) next to each other; complete descriptions included. **New Method Steel Stamps, Inc.,** 147 Jos. Campau, Detroit 7. **L-6-3**

Boosters, Fluid Pressure

Advantages and applications for dual pressure boosters highlighted in editorial reprint "Boosters and Their Practical Application"; circuit drawing, illustrations, detailed description of typical applications included. **Miller Motor Co.,** 4027 N. Kedzie Ave., Chicago 18. **L-6-4.**

Cutters, Rotary.

Bulletin 103 describes line of tungsten carbide rotary cutters; illustrates in actual size all the 10 shapes available as standard tools in 1/8, 1/4, 3/8 and 1/2 in. diameters. Includes details concerning special shapes, forms and grinds. **S & E Machine Products, Inc.,** Bridgeport, Mich. **L-6-5.**

Aligning

Circular describes the "Tumico King Way" alignment instrument for levelling and aligning new machine tools as well as for rebuilding rescraping used machines to alignment of various V-shaped and flat ways. Pictures and drawings show successive steps of application, with simple explanations. **Geo. Scherr Co., Inc.,** 200 Lafayette St., New York 12. **L-6-6.**

Lathes

Forming, turning, drilling and cutting off Traub automatic lathe by Reichenbach-Fils of Germany, described in detail in circular which outlines general dimensions and also discusses and pictures special equipment and attachments; illustrates, in actual size, examples of work turned out on this equipment. **E. R. Bachmann Corp.,** 130 W. 42nd St., New York 18. **L-6-7.**

Punches and Dies

Illustrated circular No. 533 on punches and dies and miscellaneous tools gives main points of each unit plus tables of sizes and prices; also includes general useful information and simple formulas applicable to this line. **Pratt & Whitney, Div. Niles-Bement-Pond Co.,** West Hartford 1, Conn. **L-6-8.**

Welding

Folder 5101 on three-phase aircraft welding of aluminum and alloy steels pictures press type and rocker arm spot welders and recently introduced press type combination spot and projection welders, emphasizing special features; includes specification data **Progressive Welder Sales Co.,** 3679 E. Outer Dr., Detroit 34. **L-6-9.**

Holders, Cutting Tool

Informative illustrated booklet covers spring tool holders for all types and sizes including threading, forming and cutting; also shows lathe tool holders, shaper and planer tools, boring bar and internal threading tool holders, tool bits and blades; each shown and described; sizes and prices also given. **Ready Tool Co.,** 554 Iranistan Ave., Bridgeport, Conn. **L-6-10.**

Fluids, Hydraulic

Twelve-page booklet presents details of physical properties, advantages and uses of fire-resistant hydraudic fluids; also explains how to use, methods, and where applications are particularly desirable; charts and graphs illustrate various points. **Carbide and Carbon Chemicals Div.,** 30 E. 42nd St., New York 17. **L-6-11.**

Drilling

"More Holes in a Hurry" gives working knowledge of portable electric drills, their care and how and where to use them; step-by-step explanations of technical drilling operations included as well as tables and charts for quick reference to drill sizes and speeds required for job. **Mall Tool Co.,** 7702-0 S. Chicago Ave., Chicago 19. **L-6-12.**

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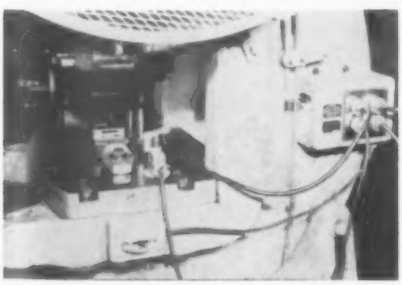
Staking Press

An air-powered bench type press for light staking, riveting and punching operations is said to deliver up to 60 spring powered blows per minute with variable impacts up to 12000 lbs., or an adjustable air-powered squeeze up to 12 times line pressure. As there is no rebound, it can also be used for delicate marking operations.

Base is 8 x 10 in., height 30 in., throat 10 x 4½ in., and stroke adjustable from 1 to 2 in. Two-hand controls provide safe manual feed, while an accessory slide feed permits foot operation up to 75 or more per minute. The latter—an air-operated accessory—features automatic ejection of finished parts. Complete details on the Model RR-6A press may be had from Winter Products Inc., Box 3112, Barnum Sta., Bridgeport, Conn.

T-6-1011

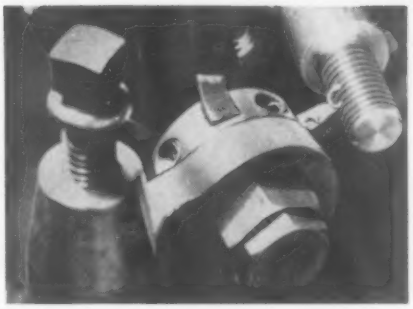
Machine Safeguard



The U.S. Tool Co., Ampere, N. J., announces the U.S. "Multi-Stop" as an addition to its line of tools. This is essentially a protective device to safeguard machines, presses, and incidental tools.

As applied to a punch press, for example, it will automatically stop the press at the end of a coil or strip; stop the machine if stock buckles between feed unit or die; if thickness or width of stock varies beyond specified limits; or, in case of a short feed. **T-6-1012**

Turret Tool Holder



A vertical turret tool holder, by Wilgus Mfg. Co., 1722 E. 16th St., Los Angeles, Calif., has a quick indexing head which accommodates four differently ground tool bits. These may be progressively or selectively brought into working position by indexing the turret.

An internal locking pin, located at the end of the shank and beneath the base of each tool bit, positions each tool. Tightening a locknut secures the turret in working position. The indexing head takes 5/16 in. square tool bits, and the tool may be had with R.H., L.H. or straight shanks. **T-6-1013**

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Technical Shorts . . .

THE ELEMENT TITANIUM, though discovered more than 150 years ago and recognized as one of the workable metals about 1910, is only now being hailed as one of the up-and-coming tonnage metals on our horizon. Now rated as the earth's fourth most abundant structural metal, its attractive properties have been known only for the past few years. Titanium is lighter than iron, stronger than aluminum, more corrosion-resistant than stainless steel and more abundant in the earth's crust than copper. However, it has been but recently that metallurgists have had any measure of success in their efforts to discover an economical method of extracting pure titanium from its ores.

The high melting point, more than twice that of aluminum, suggests the possibility that titanium or one of its alloys can be used for many "hot spots" in engines, or equipment that now require steel.

Discussion of the subject was made recently by Dr. Julian Glasser, research metallurgist at Armour Research Foundation, Illinois Institute of Technology, who is working on a plan to make the Foundation a clearing house for all analytical methods on the metal and its alloys. According to Dr. Glasser, this plan would tend to reduce the time needed for research which will make titanium commercially available.

In this connection, a national meeting, sponsored by the Foundation, is scheduled for June 11-13 at the Sheraton Hotel in Chicago. According to Dr. Glasser and Dr. Max Hansen, co-chairmen of the Symposium on Analysis and Metallorgrophy, viewpoints of the manufacturer, user and research scientists will be considered at five panel sessions to be headed by experts on titanium.

DATA SHEETS providing information for the application of a technique for motion-time work-measurement to a wide range of manual tasks in job lot industrial production have been prepared by The Work-Factor Co., 366 Madison Ave., New York 17.

Abbreviated in form, the standards are supposed to be particularly useful where accurate estimating of labor cost, in advance of actual production, is required quickly, or where it is desirable to determine incentive rates on small quantity non-repetitive or long cycle operations.

The data sheets include summary of development of detailed and simplified Work-Factor Time Standards systems, definition of the abbreviated time unit, illustrated explanation of the elements of work-motions and definition of their appraisal in abbreviated motion-time application, examples of the application to individual work-motion elements, examples of application to complete operations, and typical filled-in form of prerate sheets. **$1.**

A COURSE ON the principles of drop forging has recently been reissued by the Chambersburg Engineering Co. Prepared originally a few years ago, in cooperation with the School of Engineering of Princeton University, the material is combined in text form containing baic information useable as a home-study course.

Divided into five sections, material covered includes reasons for producing a part by drop forging rather than by other processes; details of machinery used; basic rules to be followed in designing a part for drop forging; sequence of steps in process and basic principles of design; manufacturing tolerances. Copies and information available from the company, Chambersburg, Pa. **$1.50.**

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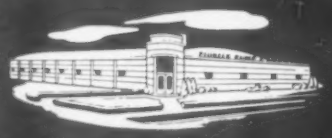

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WRITE FOR CATALOG

INDICATE A-6-103-1

INDUSTRIAL DESIGNERS and fabricators recently were warned against indiscriminate use of plastics to replace metals and scarce materials by Dr. D. S. Frederick, chairman of the plastics committee of the Manufacturing Chemists' Association. He urged that careful study be given to contemplated new applications to make certain the plastics are properly used and will do a satisfactory job, stressing the fact that plastics, though they possess characteristics which, for many uses make them superior to other material, also have limitations that should be recognized, and if misapplied may result in loss of confidence by the public in a valuable new class of engineering materials.

Dr. Frederick cautioned, too, against the belief that supplies of plastics are relatively plentiful, since some are as critical as steel and aluminum.

As with metals and wood, Dr. Frederick says, plastics are made up of a variety of basic types, and their individual characteristics differ widely. For this reason, proper structural design is of paramount importance, and new users of plastics will do well to consult a designer who has had experience with these materials.

DEVELOPMENT OF an air-drying plastic protective coating has been announced from the United States Rubber Company. Designed to protect equipment against attack by splash, drip and spray from corrosive chemicals, corrosive atmospheres, weathering and rust, the material is expected, according to its researchers, to find its broadest use in chemical processing, filtering and electroplating, mining operations and celephane production among other uses.

High film flexibility with good adhesion and impact resistance are said to be outstanding attributes of the coating, plus the fact that it is said not to chip or crack and, therefore, can be used on steel, aluminum, concrete and other similar substances.

Applied by spray, it requires an hour for drying time between coats and 24 hours after the final coat.

Since, it contains no chemical plasticizer the material, it is claimed, holds its flexibility throughout its service life.

JUNE 18 THROUGH 22 are the dates for the next private seminar on the organization and operation of company standardization work, held by Dr. John Gaillard in the Engineering Societies Bldg., New York City. This previously was reported as beginning June 8. Details and registration may be handled through Dr. Gaillard, 400 W. 118 St., New York 27. Seventy-three companies so far have been represented at the various Gaillard Seminars.

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INDICATE A-6-103-2

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INDICATE A-6-104

Abstracts Of

Foreign Technical Literature

By M. Kronenberg

Great Britain: Economy in the use of tungsten, the material which is the major ingredient (95 percent) of carbide tools, is discussed in an article published in the March 22 issue of the British edition of *Machinery*. In normal times economy in the use of cutting materials seldom receives the full consideration it deserves. The effect of any wastefulness is then confined to the factory where it occurs, while, under the present unstable political situation in the world, a position may soon arise where extravagance in one plant may result in reduction of supply of urgently needed tools to others.

There is much to be done to ameliorate this situation if all concerned will cooperate to avoid waste of tungsten in any form. The author suggests systematic investigations be carried out in all plants to determine the rigidity of machine tools, their freedom from vibration, and to ascertain whether the tools possess sufficient power, speeds, feeds, etc. He also suggests brazing methods, tool angles be improved, and tungsten be replaced by cast cutters of chromium steel where possible. Ceramic tipped cutters were offered as an alternative to cemented carbide cutters.

Topics touched on at the annual meeting of the Institute of Metals held recently in London, are of interest to tool engineers since problems in metal cutting are often similar to those occurring in the plastic flow of metals caused by cold working. M. Cook and T. L. Richards presented a paper on the fundamental aspects of the working of nonferrous metals and alloys, as indicated in an article in *Engineering* of March 23, dealing with the nature of the internal changes involved in cold plastic deformation. The authors referred to the nature of metallic cohesion in terms of the electron theory of metals and outlined the mechanisms involved in plastic deformation. These included crystallographic slip, twinning and "kinking" which involved relatively small atomic movements throughout extensive regions of stressed crystals. When the strip thickness was reduced by cold rolling in excess of 50 percent, the deformation occurred by shear upon planes situated transversely to the rolling direction and inclined to the strip surface.

A paper on "Welding of heat resistant alloys in sheet form" was presented in London by H. E. Lardge and published in *The Engineer* of March 16, as a contribution to a symposium on high temperature steels and alloys for gas engines. A brief description of the sheet metal parts of a typical jet propulsion unit is given followed by notes on the characteristics of the material used which affect welding. The use of oxyacetylene torch and of carbon argon and metallic arc processes are then discussed, completed by a description of the techniques developed for the resistance processes of spot, stitch and seam welding as applied to gas turbines and of the electrical resistance hot riveting method for use with stainless steel rivets.

A look behind the "Iron Curtain" in Europe is taken in an article on the Leipzig Technical Show in East Germany, published in *The Engineer* of March 30. Among machine tools exhibited there, the new design of a large vertical boring mill may be of interest. The machine, which will be erected at the Borsig plant in Berlin for machining of steam turbine parts and generators, differs from the usual boring mill in that the work is stationary. The tool, on the other hand, revolves on an arm carrying the tool box suspended between the two housings. Total height of the machine is about 45 ft. The boring bar is provided with its own feed and speed control, and the table is extended considerably beyond the machine, rendering it possible to lower the work on it from a crane and to clear the machine entirely.

France: Representatives of the machine tool industries in France, Sweden, Italy, The Netherlands, Belgium and Germany have established recently a new organization which may be termed "The European Machine Tool Board" (Le Comité Européen de Coopération des Industries de la Machine Outil). Purpose and program of the board are discussed in the January issue of the French magazine *La Machine Outil Française*. The board is sponsoring the first European Machine Tool Show to be held from September 1 through September 10 at Paris. It will be limited to machine tool manufacturers of the member countries, supplemented by those of other countries by invitation. About 500 to 600 companies from 12 European and North American countries are expected to show their latest developments in machine tools.

In addition to sponsoring the exhibition, the European Machine Tool Board plans to develop, by cooperation of the

various countries, common sales organizations, trade agreements and information centers for European machine tools.

Germany: E. Broedner discusses his experiences with a tracer controlled lathe of Swiss origin in an article in the February issue of *Werkstattstechnik und Maschinenbau*. This machine, which is equipped with an electrical foot control for operating the chuck, has a swing over ways of 18 in. The feed is engaged by a push button which controls a magnetic device for operating a hydraulic valve in the apron. Under otherwise identical conditions the floor to floor time was reduced from 7.5 min. to 3.9 min. in one series of tests and from 24 min. to 7.25 min. in another series. Cutting speeds varied between 300 and 375 fpm.

Tests on small helical gears with 0-, 15-and 45-deg helices were made by G. Nieman and H. Glaubitz in order to supplement lacking data on the effect of the helix angle on the load carrying capacity of the teeth at the dedendum circle. They investigated also the effect of the helix on wear resistance, heat development and noise and have published the results in *Zeitschrift des Vereins Deutscher Ingenieure* of March 21.

The gears were identical in material and accuracy of pitch. Resistance to wear and beam load carrying capacity were found to increase with increasing helix angle, while the temperatures of the oil was not affected by the helix but only by the applied load. Temperatures in the case of idling gears, however, were larger for greater helical angles of the teeth, while a reduction in noise occurred as the helical angle was increased.

Various new types of motion of machine tool members can be obtained when following the mathematical analysis on the "Generalized Principles of Planetary Gears" published by Dschang-Djin-Hsian of Shanghai, China, in *Zeitschrift des Vereins Deutscher Ingenieure* of March 21. Replacing the uniform rotation, used when driving simple planetary gears, by other types of motions results in a great variety of movements, different directions of rotations, intermittent returns and various ratios of transmission which are explained in the article.

In the same issue of the above quoted magazine, R. Kraus has published an article dealing with change gears and means for obtaining geometric progressions by an additional shaft instead of using a great number of gears. It is claimed that this method is less expensive. The author develops his theory for various combinations of change gears and shafts, analyzing such cases as the coordination of change gears and three shafts, or the coordination of four shafts and one additional shaft, etc.

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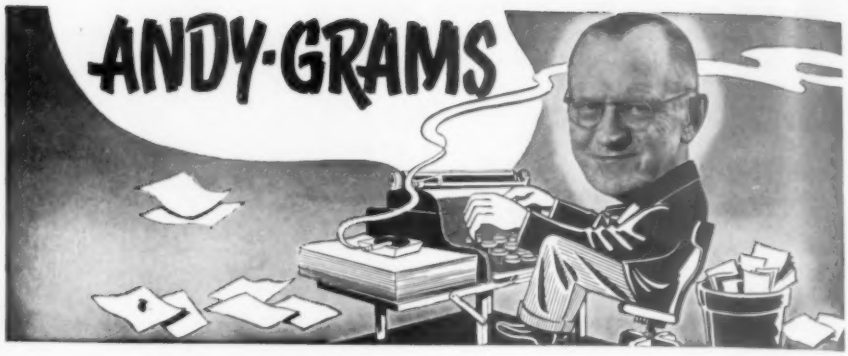
ANDY-GRAMS



Taking one thing at a time, I'll start with a joint dinner meeting of the American Ceramic Soc'y and the Eng'g Soc. of Detroit on April 11, ASTEer Grant Wilcox presiding as prex of the latter society. There, had the pleasure of hearing Dr. C. O. Christianson of University of Minnesota, with whom I was previously acquainted, speak on "Rediscovering America in Europe." I wish that Dr. Christianson—who, incidentally, is retained as a special lecturer by General Motors—could deliver his message on Americanism to every ASTE chapter. He is worth hearing.

On April 17, the executive luncheon at Lafayette Hotel, Rockford, attended by most of Rockford's industrial brass that could get away from their chores. This meeting was by way of a "trial horse" for the ASTE Continuous Modernization Plan which, in turn, is the result of an extensive survey conducted under the Society's auspices. There's a lotof meat in it.

A poor hand at catching names in a crowd, I can't mention all who attended, yet missed *auld acquaintance* who couldn't come. At lunch, found myself table mate with "Westy" Westlund, Ernest Norrman, Bob Jacobs, Kou Klein, and Roscoe Brightup whose name didn't click until he pointed to my own bright top. Nice chaps who'd wear well on a fishing trip. A chat with Bill Morelandson, erstwhile of Detroit but now a Rockford native.

After dinner speakers, introduced by chapter ch'man George Torrence, were Harry Conrad, Ray Putnam—who outlined the plan—and Roger Waindle, ASTE Director, all of whom did right well. Others from Society HQ were Clarence Etter, adv. mgr., Stan Girard, western mgr., Gil Muir and myself. I just did the heavy looking on.

After a brisk walk from the Lafayette to the Faust, Stan Girard inveigled Ray Putnam and myself into a bowling match—my first since '35. Was I rusty! But Ray, who'd never bowled before, amazed us with his mastery of the pins. Oh well, youth will be served. Just before leaving, a skoal and an oyster with Ernest Svenson, whom I cornered smorgasbording in the coffee shop. Thanks for, the oyster, Ernest—it went a long way.

Back in Detroit in time to drive out to Frankenmuth, meeting place of Saginaw Valley chapter's panel on metal presswork where, on invitation of ch'man Russ Ayers, I served as moderator—or, as it turned out, heckler. Fortunately, the members of the panel—Al Blackmon, technical ch'man; Walter Hanna, Clif Geddis, Ronald Warner, Ed Reed and Jack Puderbach—were all seasoned tool engineers and so weathered a barrage of questions from the floor without mussing a hair. A lively meeting by an up 'n' coming ASTE chapter.

A look-in on Daddy of the ASTE O. B. Jones on the occasion of Old Timers night at his Detroit College of Applied Science; there, met old friends including former students who have since climbed the industrial ladder. O. B. still hunts, his latest feat being killing two bears with one shot. Got 'em hanging on the wall.

A note from Harry Satterthwaite a/c somebody's *anagrammed* his name something awful. But then, look at the way they vary Shakespeare's name; no matter how you spell it you're either dead right or dead wrong. Also, a letter from another ASTE wheelhorse, one of many that adds grist to the mill.

Dear Andy:

. . . . .still alive and kicking up here in the Green Mts. . . . the last paragraph your April Andygrams got me started. The method there suggested (for growing hair) certainly would work on roses but by godfrey there's nary a rose on your pate or mine to work with.

After my eyes went bad I moved with my family to my summer place and have been carpenter and jack of-all-trades using power tools to produce doors, sash and trim out of native wood. Occasionally get to Twin States chapter . . . had planned to meet with the boys in New York but was elected Town Moderator and . . . town affairs put a crimp in my plans. It pleases me to see the ASTE grow . . . at times, I get a bit low feeling I have to sit on the sidelines. With best regards . . . and expressing the hope that the Society will continue to flourish I am

Yours

Ray E. Gifford, Past Ch'man

New Haven chapter.

Ray may be on the sidelines but he's still in there rooting for the team. As for missing the '51 Annual, there were members with worse luck; f'instance, Jimmy Giern got to N.Y. but missed the meeting a/c coming down with the flu. Heluva note! Now, with regard to Ray, should auld acquaintance be forgot? Heck no! So, I want you boys N.E.W.S. to write him a letter now and then—address Bondville, Vt.—to provide diversion when the spirit is low. Do it now! —and then again the way John Sylvester sends me a missive now and then if only a newspaper clipping. They help in dark moments.

On invitation by prime mover Fred Kessenich, went up to Madison chapter on May 8 to coffee talk at their combined Past Ch'men & Executive meeting. A really nice get-together with plenty of brass present from local industry as well as from surrounding territory including Parker Pen, Chicago, Milwaukee, Rockford and Fond du Lac, the latter providing opportunity to relay greetings to Bill Rutz and his fellows at Giddings & Lewis. Here's how, Bill!

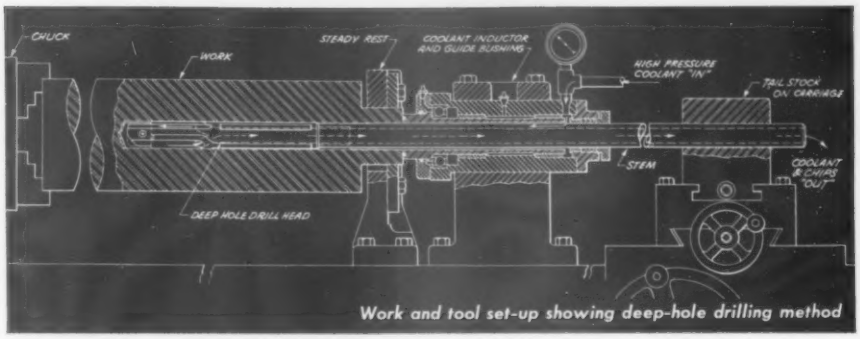
To highlight the meeting, Director-elect W. B. McClellan breezed in as a surprise package and paid Madison chapter some very nice compliments which, incidentally, was well deserved. As usual, Slim went over in a big way. But then, he should. Speaking for myself, I had a royal welcome a/c being a charter member—that is, I was there along with Harry Conrad, Brad Pierce, Bob Douglas, Larry Rademacher and others when Madison was christened as one of the off-spring of the ASTE. Anyway, I felt right at home.

Guest technical speaker was Gunnar Danielson of O'Neil-Irwin Mfg. Co., assisted by Vincent Peterson, both of whom later demonstrated the company's die-less equipment. Those little machines are certainly versatile and, as far as power is concerned, veritable "little giants." Playing around with 'em after the meeting, I had a yen to buy a few and go into business making gadgets.

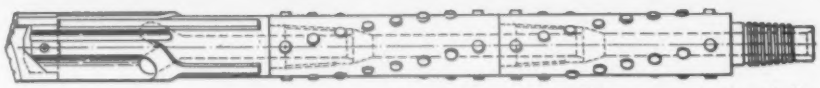
Back on the job in time to go with Harry Conrad and Jack Eacock to the Primeweld Corp., where prex Harry Marx gave a demonstration of "electro-kinetics" which we may show in The Tools of Today in an early issue. And that's all for now except I'd like to know whyinell hotels put the light on bathroom mirrors up in the air so you can't see your chin when you shave. Let's do something about it!

ASTEely yours

Andy



Work and tool set-up showing deep-hole drilling method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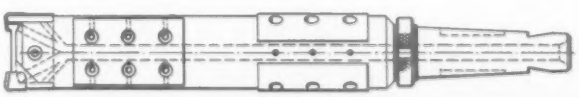
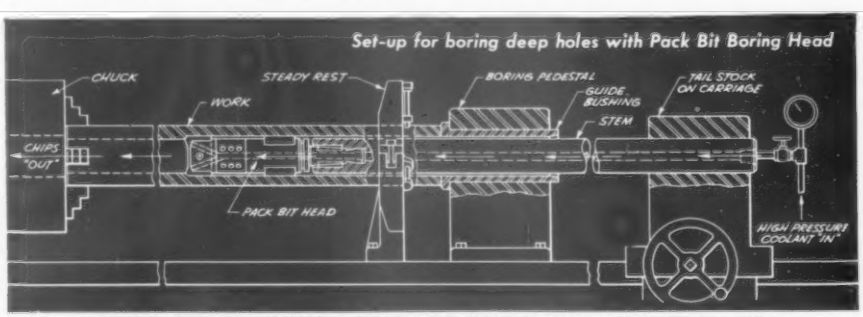

Conner Pack Bit Boring Head



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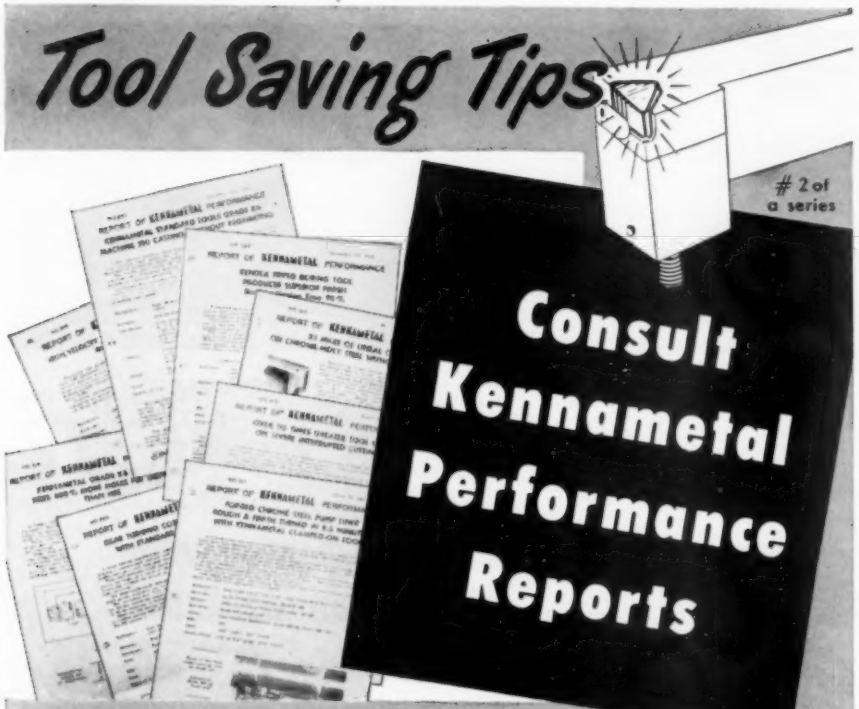
Tool Saving Tips



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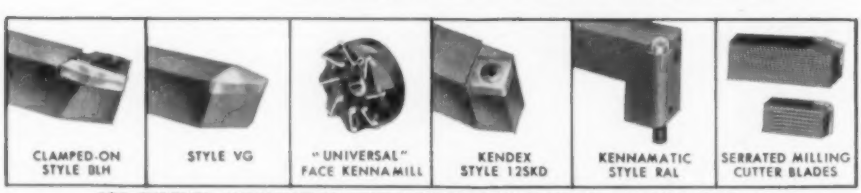

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Good Reading

A GUIDE TO SIGNIFICANT BOOKS AND PAMPHLETS OF INTEREST TO TOOL ENGINEERS

METAL WORKING LUBRICANTS, by E. L. H. Bastian, staff engineer, Shell Oil Co. Published by McGraw-Hill Book Company, New York, N.Y. 357 pp., price $6.00.

In this book, the author provides a comprehensive guide toward a more efficient use of lubricants and fluids not only for metal working but also for forming of non-metallic materials such as plastics. He further provides practical know-how on the nature and formulations of metal-working lubricants, such as properties affecting their performance under specific conditions and operations, their proper use in the plant, and means to obtain top efficiency from their use.

Providing needed theoretical background as well as on-the-job aid to shopmen who are mainly concerned with what lubricants to use and how to use them, it provides charts, tables and practical operating procedures as given by plant engineers and production executives. It covers all types of lubricants—cutting fluids and compounds; extrusion and forging lubricants, mold coatings, rolling oils and so on—and particularly those lubricants used in metal-working processes.

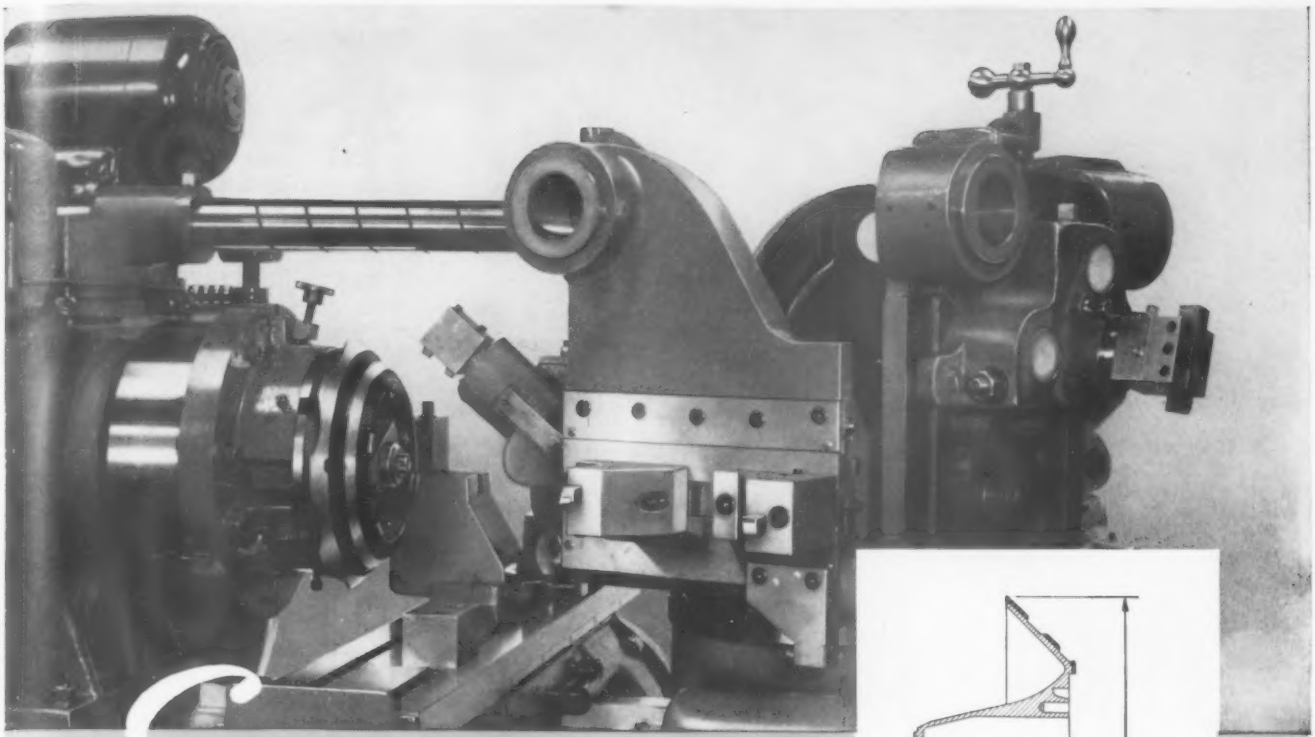
Marks MECHANICAL ENGINEERS HANDBOOK, edited by Lionel S. Marks; published by McGraw-Hill Book Co., New York, N.Y. A revised 5th edition in sixteen sections, 2236 pp.; price $15.00.

A collaboration by one hundred engineers, each an authority in his field, this volume provides concise yet comprehensive coverage of mechanical engineering theory, standards and practice in such fields as aeronautics, mechanical refrigeration, power generation, welding, metal cutting and so on.

Under the heading of theory are discussed significant recent developments in the field of fluid mechanics, stresses in turbine discs, transonic and supersonic aerodynamics, aircraft jet propulsion, rockets, and television. Under processes, one will find discussed radiant or panel heating, solar heating, high-vacuum pumps, industrial supersonics, modern casting methods, statistical quality control and automatic process control.

Also included are materials of engineering — ferrous, non-ferrous and high-temperature alloys, silicones,

(Continued on page 110)



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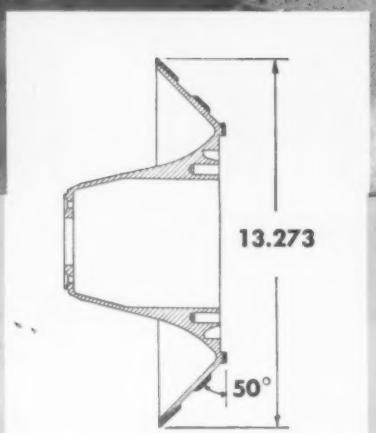

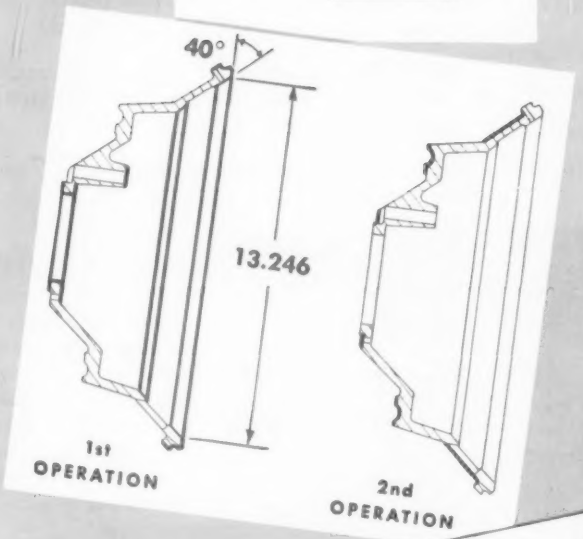

P&J Tool Engineers designed this setup for the rough and precision-finish machining of these two rather frail cast iron braiding machine parts.

Note the 50° angular surface on the one part, and the 40° angular surfaces on the other. These angular cuts present no problem to the P&J-designed single point angular slide tool clearly visible in the photograph, while the work is rigidly supported at the rear of the rim to prevent chatter. All other surfaces (indicated by heavy lines in the drawings) are precision finished without distortion — and to the split-thousandth tolerances specified — by this P&J Tooling set up on the P&J 5D AUTOMATIC.

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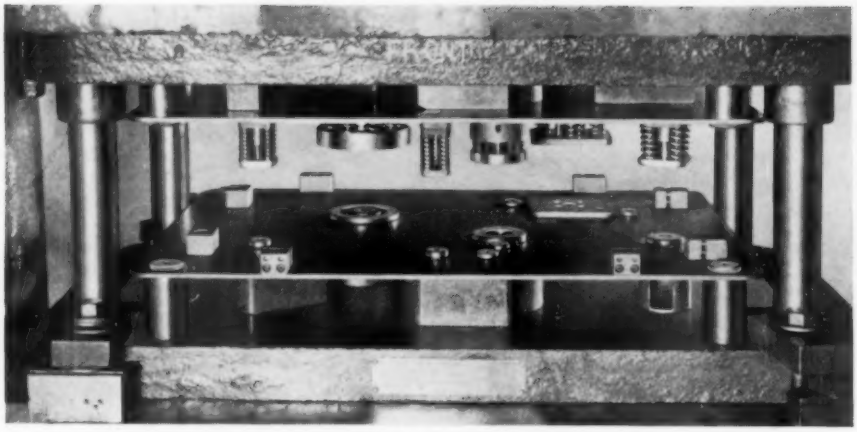

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Magnetic PERFORATING DIES

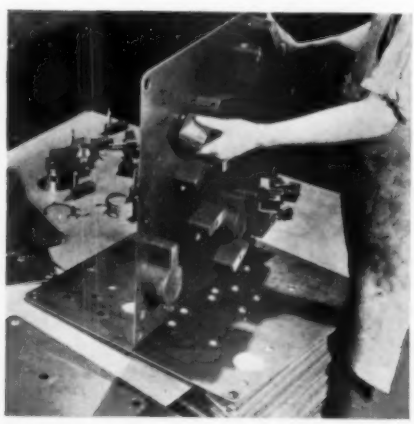
NEW and FAST Method for perforating Sheet Metal

SAVE PRESS DOWN TIME. Approximately 15 minutes required to change from punching one subject of say 20 holes to a different 20 hole arrangement. Whistler Magnetic Perforating Dies *increase* press production.

HOLD CLOSE TOLERANCES. Hole centers may be held to .0005" accuracy or as close as can be jig bored.

GREATER PUNCH AND DIE LIFE. Concentricity of punch and die assured thus giving uniform clearance around punch, increasing punch and die life.

SAVE FLOOR SPACE. Die storage cut to a minimum because only the 2 locating templets are stored...all that is required to duplicate the set-up.



● Die retainers complete with bushings being inserted in die templet.

REDUCE DIE COSTS. Whistler Magnetic Perforating Punch and Die units are used repeatedly for different hole arrangements. When completing one job, remove all units from templet and put them into service on the next different set-up. Combine any number of hole sizes and shapes. Punch and die costs are amortized over continued reuse in many jobs.

Write for Catalog...

Whistler Magnetic Perforating Punches and Dies have *proven* their cost-cutting advantages in many prominent plants. The catalog shows how. Send for it today.

S. B. WHISTLER & SONS, Inc.

744 MILITARY ROAD, BUFFALO 17, NEW YORK

Also manufacturers of a complete line of drawing, forming, blanking and progressive dies to special requirements.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-110

GOOD READING . . .

(Continued from page 108)

rocket fuels and powder metallurgy. Power costs are analyzed, as are gas turbines and atomic energy as power sources. A completely cross-referenced index of over 12,000 entries provide for daily needs of engineers who need facts of their profession at their fingertips.

PLANT LAYOUT, PLANNING AND PRACTICE, by Randolph W. Mallick and Armand T. Gaudreau. Published by John Wiley & Sons, New York, N.Y. 391 pp.; price $7.50.

This is an authoritative work of equal interest to the administrative executive and plant engineer as well as senior and junior engineers; it is also an excellent reference for engineering colleges and schools of business administration.

While the authors are outstanding in their field—Mr. Mallick, for instance, is an ASTE member and a contributor to THE TOOL ENGINEER—they have nevertheless drawn heavily on related text matter from contemporary authorities; as a result, the book presents a cross section of the best and latest in plant layout procedure.

The book features complete engineering techniques with principles and practice of planning, designing and presenting; plant layout projects covering relayouts and new plants; designing production and assembly lines—the gamut from receiving to shipping including office space and service facilities. An interesting chapter is devoted to scale models.

THE BEHAVIOR OF ENGINEERING METALS, by H. W. Gillett. Published by John Wiley & Sons, Inc., New York, N.Y.; in London by Chapman & Hall, Ltd. 395 pp.; price $6.50.

In this book, published posthumously, the author has presented the viewpoint of the metallurgist for those who have not specialized in this field. Because it is intended to help in selecting proper engineering materials, their actual behavior, rather than theories leading to explain behavior, is discussed in plain language and, as far as practical, without undue use of technical terms. The book as a whole is "easy reading".

The book introduces the basic concepts of metallurgy, the terms being presented in natural sequence with examples to show use. It goes on to deal with the behavior of each of the principal commercial metals and alloys, concluding with special considerations that may influence selection. These include machinability, special fabricating techniques, selection to combat effects of corrosion, wear and high temperature, along with "tricks of the trade". The book closes with vital factors of cost and availability.

this new book tells how you can reduce gear cutting tool costs

- ✓ lower original tool costs
- ✓ longer sharpening life
- ✓ reliable accuracy

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. . . and see what Illinois Tool Works *Certified* Unground Hobs will do in your shop. Detailed information is included on tolerances, performance characteristics and application.

Remember, every Illinois Tool Works *Certified* Unground Hob is shipped with the automatically produced Toolgraph* Chart, your certificate of accuracy! Send for your copy of "*Certified* Unground Hobs by Illinois Tool Works" now!

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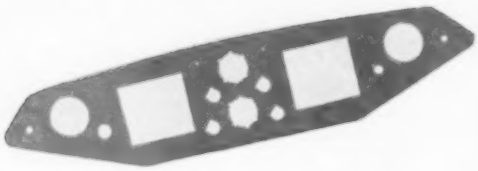
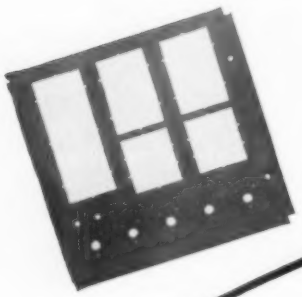
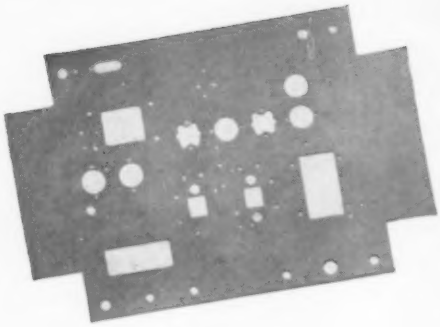
if you produce...

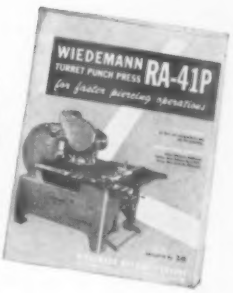


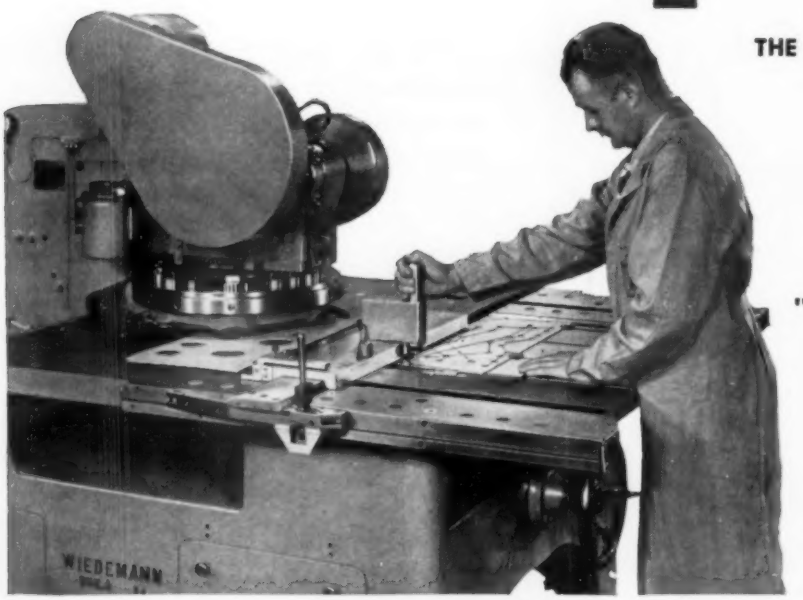




SEE WIEDEMANN

Bulletin 241 describes the most efficient method of producing chassis and similar work in short runs and semi-production runs. Repeat runs of 5 to 1,500 pieces and single runs of 50 to 5,000 pieces are economically produced on the Wiedemann RA-41P. Write today for bulletin 241.





THE WIEDEMANN METHOD permits you to: (1) Keep up with engineering changes without materially affecting production schedule; (2) Keep tool inventory low; (3) Produce quantities in accordance with sales requirements; (4) Produce accurate work with inexpensive tools.

"THE WIEDEMANN METHOD" through the elimination of expensive punch and die set-up and work location methods, provides an efficient means of piercing single pieces, and semi-production runs, regardless of repeat frequency.

Machines available for piercing sheet and plate up to ½" thick, up to 120" wide x 200" long.

Wiedemann
TURRET PUNCH PRESSES

WIEDEMANN MACHINE COMPANY

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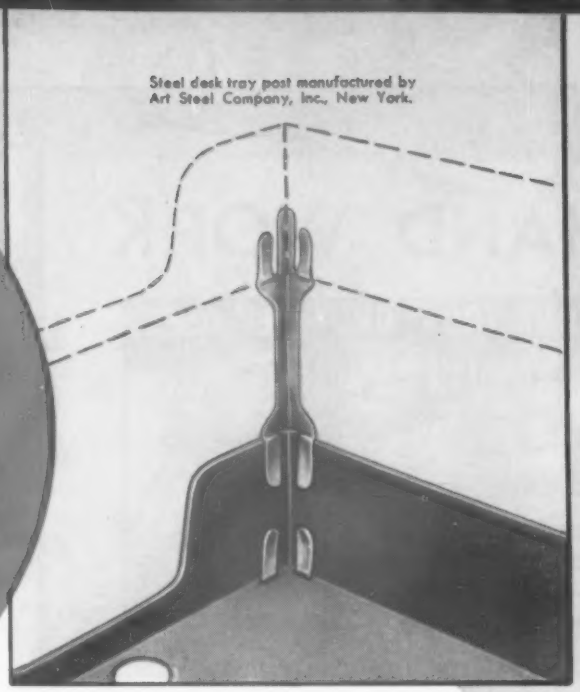
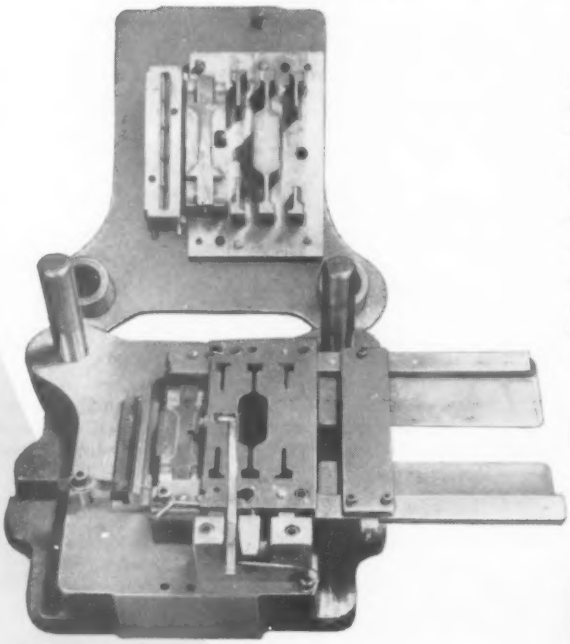

Steel desk tray post manufactured by Art Steel Company, Inc., New York.

they built the die in a

DANLY DIE SET!



Dependable, long wearing dies are a must in stamping the desk tray posts shown above because of volume production requirements. The dies have to be sturdy, too, to withstand the combination of high speed operation and heavy stock.

That's why Art Steel Company, Inc., of New York, chose a Danly Die Set. Outstanding performance in jobs like this has made them the first choice of die makers everywhere. Just call your nearest Danly Branch Assembly Plant* for quick attention to *your* specific die set needs.

DANLY MACHINE SPECIALTIES, INC.

2100 South Laramie Avenue, Chicago 50, Illinois

PRECISION DIE SETS . . . STANDARD AND SPECIAL

***WHICH DANLY BRANCH IS CLOSEST TO YOU?**

Danly Branch Offices: *Chicago 50, 2100 South Laramie Avenue • *Cleveland 14, 1550 East 33rd St. • *Dayton 7, 3196 Delphos Ave. • *Detroit 16, 1549 Temple Avenue • *Grand Rapids, 113 Michigan Street N.W. • Indianapolis 4, 5 West 10th St. • *Long Island City 1, 47-28 37th St. • *Los Angeles 54, Ducommun Metals & Supply Co., 4890 South Alameda • Milwaukee 2, 111 East Wisconsin Ave. • Philadelphia 44, 18 W. Chelten Ave. • *Rochester 4, 16 Commercial St.

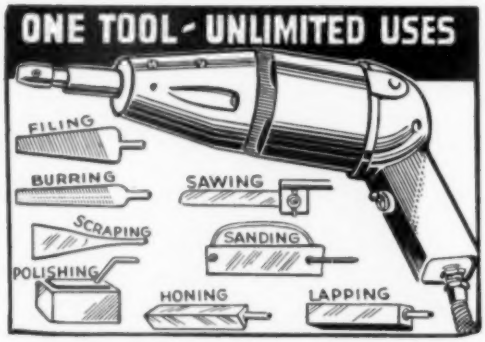
*Indicates complete stock

DANLY®

More than 25 years of dependable service to the stamping industry

STOP...

HAND WORK



Use these Handy PORTABLE, ELECTRIC RECIPROCATING TOOLS for Greater Production, Better, More Uniform Work—All with less Operator Fatigue. Fixed strokes are 1/8" or 3/8" long. Operate on 110 Volts AC-DC. Deliver 1000 PUSH-PULL strokes per minute. Try one of these tools on your next job.

It's the Grip that Counts

ACME BENCH VISES will always grip your work securely without danger of Wobbling or Side Twisting. The even, central pulling action of the spindle assures uniform holding power for either light or heavy pieces. Acme Bench Vises are made in 11 sizes from 2" to 6".

ACME COMBINATION PIPE AND BENCH VISES
Available with 3½" - 4½" or 5" Jaws.

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ACME TOOL COMPANY

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PROMPT DELIVERY

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Lang Tool and Die Manufacturing Company, Glendale, California use Cerromatrix to anchor small punches in high-production lamination dies. They guarantee these dies for 2,000,000 blanks minimum.

Punches are held vertically by cap screws and mounted in Cerromatrix. Very small punches are held by circular washers outside and inside of punch, located in a 1/8" groove ground in the punch. All small punches are guided through a fixed stripper with Nitrided inserts.

At least 1/3 of the length of the punches is held in Cerromatrix. The photograph shows a die for rotor and stator blanks. It runs 135 strokes per minute. Eighty to eighty-five thousand blanks are obtained per sharpening of die. Send for literature.

C de P ®

CERRO de PASCO Copper Corporation
31 Pine St. New York 5, N. Y.

USE READER SERVICE CARD; INDICATE A-6-114-2

WHO*

looks more like a busy, little beaver than a wise, old owl these days. But WHO* is still—

Wm. H. Ottemiller Co.*
of YORK, PA.

Even though the need for our precision, "milled-from-the-bar" screw machine products has us virtually snowed under—we invite inquiries from those of you who must have "the best."

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Specify
CEMENTED CARBIDES
★
TANTUNG CAST ALLOYS

VASCOLOY-RAMET CORPORATION
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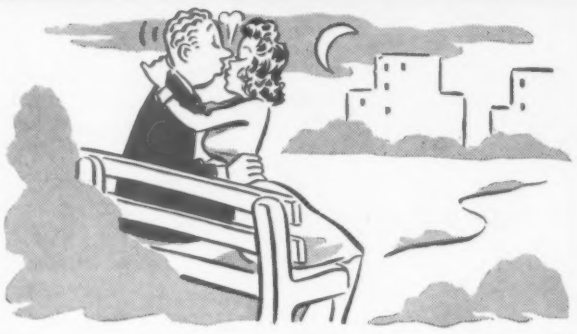
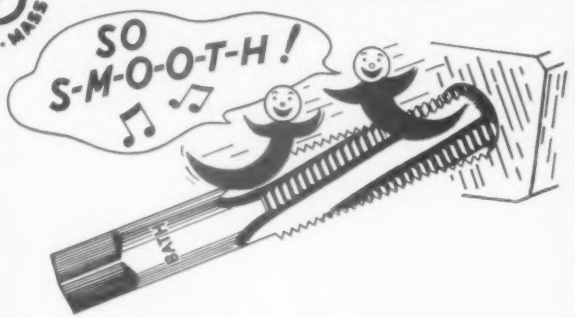


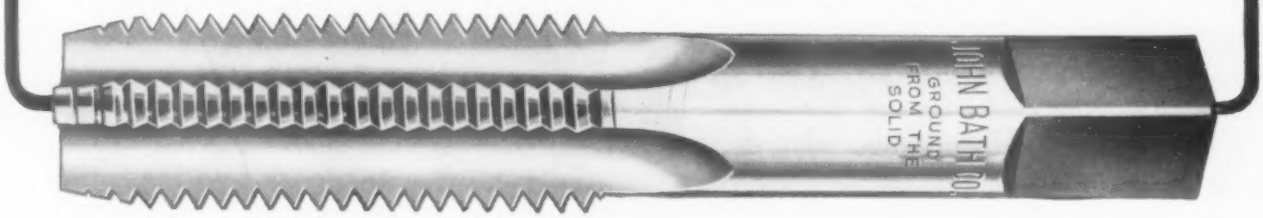
There was a young man who went on a blind date —
And in just a few days, he made her his mate!

He jumped to conclusions and found out too late —
Her beauty was false . . . her curves were all straight!

When you order Bath Taps, won't you please stress
Complete and full details! Don't make us guess!



If you want chips to slide along curves that are smooth —
Insist on Bath Taps . . . they're RIGHT "in the groove"!



INSIST ON BATH TAPS . . . PROFIT BY THEIR PLUS-PERFORMANCE

The more we know about your use for Bath Taps, the better we can serve you! Such information will allow us to automatically provide the correct design of tap and apply the proper heat treatment for the metal you wish to tap. The smooth, polished flutes on Bath "ground from the solid" taps, will allow chips to slide, instead of piling up to clog and cause tap breakage.

Full information about the material to be tapped, the machine, fixtures and lubrication will help . . . and in many cases will permit us to make suggestions that will increase your shop productions. See your Bath representative or write direct about your tap problems.

PLUG AND RING THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS

JOHN BATH CO. INCORPORATED
28 Grafton St., Worcester, Mass.

Here's

- BALANCED PRODUCTION
- SIMPLE LOADING
- AUTOMATIC CLAMPING

the *American* WAY

SIMPLE LOADING plus AUTOMATIC CLAMPING gives the manufacturer of these connecting rods and caps BALANCED PRODUCTION at the rate of 300 complete assemblies per hour.

The installation, engineered the American-way, consists of a Standard American 10-ton, 42-inch stroke vertical duplex hydraulic broaching machine and two, two-station fixtures mounted on completely automatic tilting-type work tables. Fixtures are interchangeable. One station on each fixture holds a rod part, the other a cap. The operator simply PLACES a rod and a cap on the first fixture . . . then pushes the control buttons. The parts are CLAMPED AUTOMATICALLY while the table tilts down and then broached. While one assembly is broached the operator loads the other fixture.

AMERICAN CAN HELP YOU SOLVE YOUR PRODUCTION PROBLEMS

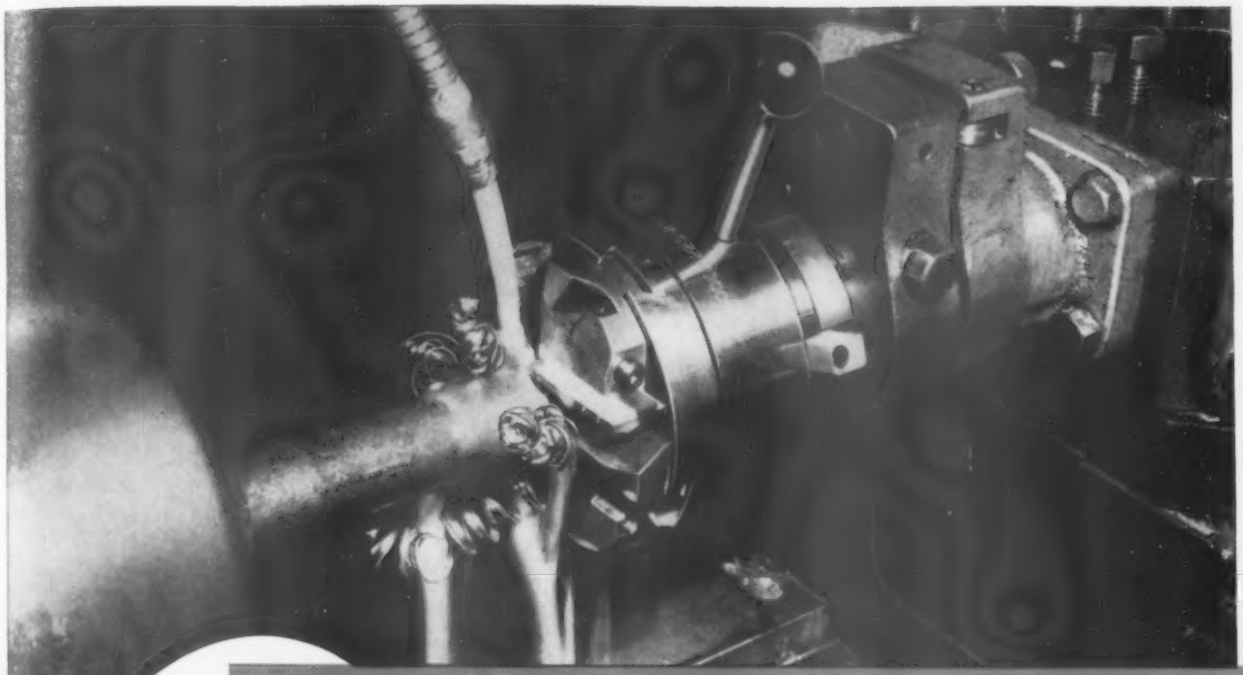
Just as American has helped thousands of other manufacturers during the past twenty-five years, they can help YOU solve your production problems. For the answer to your problems send a part-print or sample and hourly requirements. Address Dept. T.

WRITE TODAY *for your copy of American's Circular No. 300 on American Vertical Hydraulic Surface Broaching Machines.*

AMERICAN *American* BROACH & MACHINE CO.
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.
ANN ARBOR, MICHIGAN

SUNDSTRAND

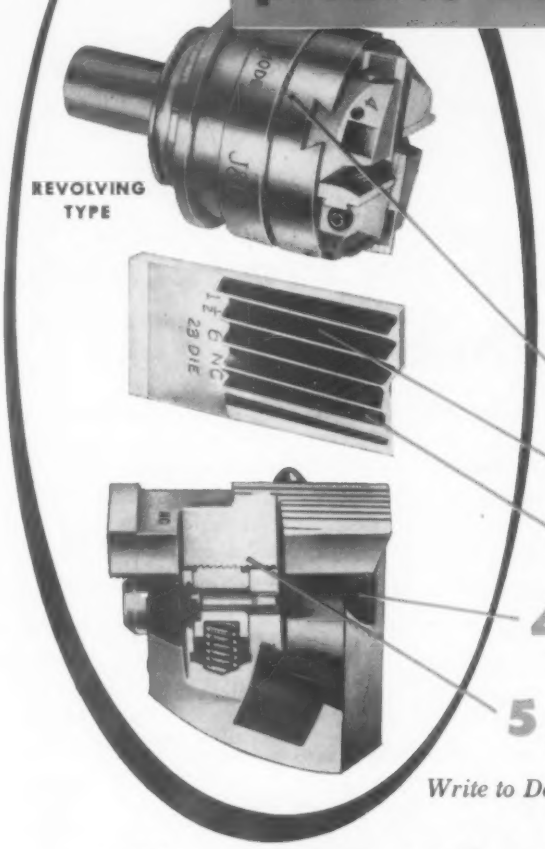
See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery



JONES & LAMSON DIE HEADS

WITH GROUND THREAD TANGENT CHASERS

produce better threads at lower cost!



J&L Tangent Chaser Die Heads are rugged, dependable, time-tested tools. They are production engineered to produce better threads at speeds limited only by the material being threaded. Capacities are from #4 to 2″.

There is a J&L Tangent Chaser Die Head engineered for your requirement. Stationary types are available for turret lathes or any machine where the tool does not turn. Revolving types are for automatic screw machines, drill presses, threading machines, or any machine where the tool is held in a live spindle.

Among the many features contributing to their ability to perform your threading job faster and better are these:

1. They are hardened and ground throughout. The chaser holding blocks are precision lapped for perfect fit into the dovetail slots in the body. Chaser cutting edges are held to a minimum distance from the die body.
2. Chasers are guaranteed to produce threads to Class #3 fit or better.
3. Exact helix angle is ground into the chasers after hardening. The result is a freer cutting tool—operating with a minimum of friction, heat and wear.
4. With a single set of chaser holders any standard thread within the rated capacity of the holders can be cut, regardless of helix angle. This eliminates the expense and trouble of constantly changing holders for different helix angles.
5. Chasers are changed and set quickly and easily, giving you more production hours each day.

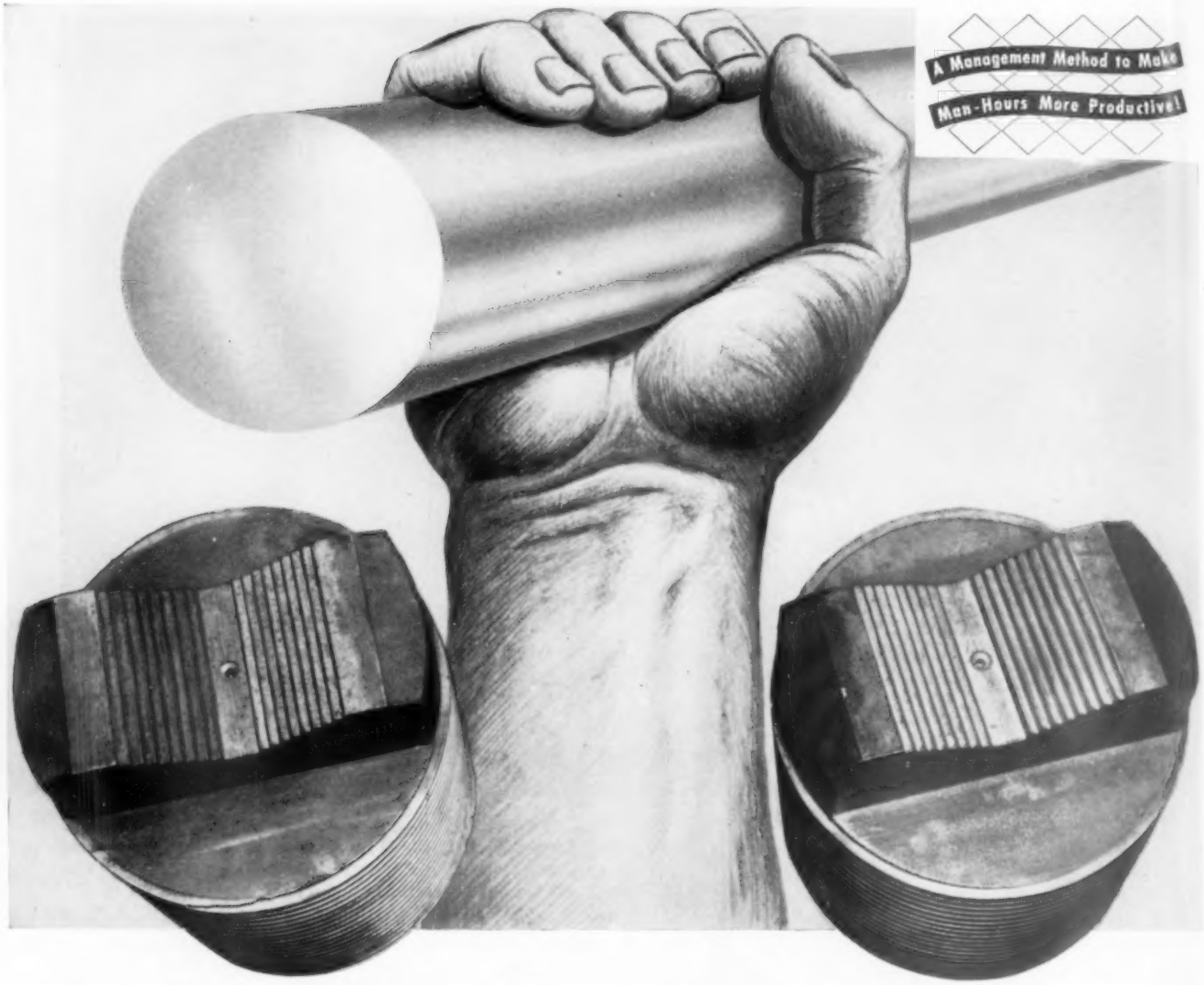
Write to Dept. 710 for catalog.

Thread Tool Division

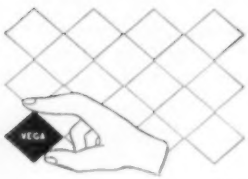
JONES & LAMSON

MACHINE COMPANY
Springfield, Vermont, U.S.A.

Machine Tool Craftsmen Since 1835



You Can Tighten Your Grip on Production with This Method



These giant jaws, made from Vega (Air-Tough) Tool Steel, grip 13½" round steel billets during rough turning in the largest machine of its type. Steady, uninterrupted production in the operation depended largely on quickly finding the right tool steel.

The company had been using an oil-hardening steel for jaws in normal-sized machines. But when the new giant came along it was a different story. Now a steel was needed that would harden uniformly, and *through very heavy sections*. By using the Carpenter Matched Set Method, the company was right the first time in selecting Vega . . . and saved costly experimenting with different tool steels. More important, production management was able to put the jaws in operation, knowing they could depend upon heavy production schedules being maintained.

This workable Method offers your plant more advantages than accurate, simplified tool steel selection. It can help you make machine operators more productive. It can do a lot to make heat treating a "routine", trouble-free procedure. It can hold your tool steel inventories to a minimum. Find out how, why and where it can work for you. Write for the new booklet "How to Get Better Tool and Die Performance". THE CARPENTER STEEL CO., 154 W. Bern St., Reading, Pa.

Export Department: The Carpenter Steel Co., Reading, Pa.—"CARSTEELCO"

Carpenter

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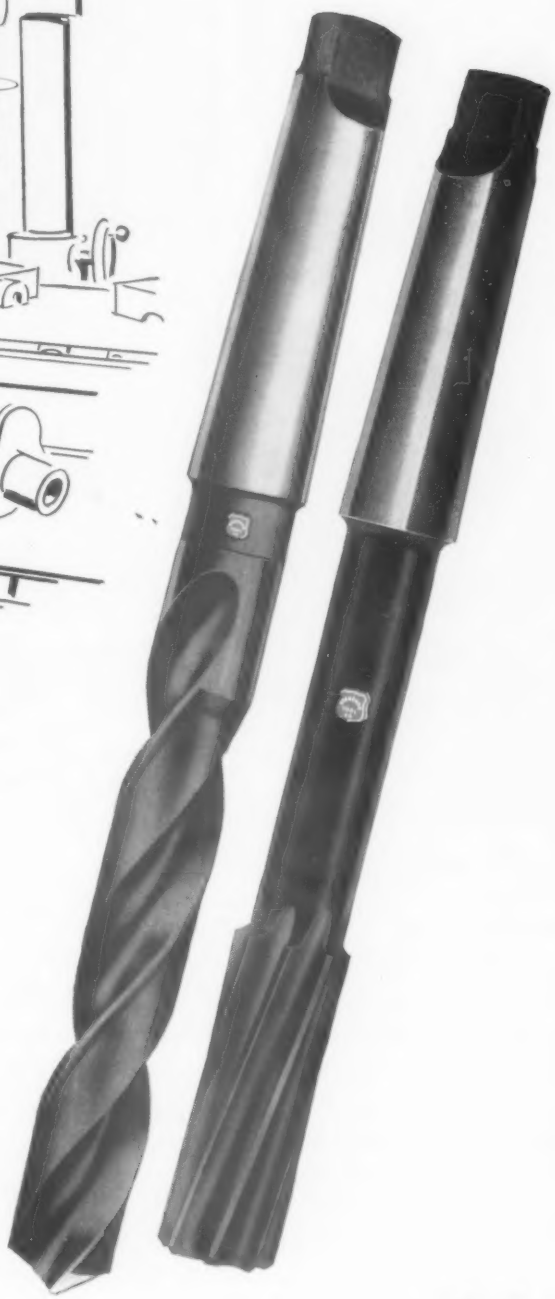
More than top-grade steels . . . a Method to keep tooling and production on schedule!

For your convenience, Carpenter carries warehouse stocks in principal cities throughout the country



PRODUCTION jobs are not delayed where Red Shield Drills are used. STANDARD tools are uniform in construction and operating characteristics. Their production is fast—economical—dependable.

Standard "Red Shield" Service Men are always available to give you the benefit of our 70 years' of accumulated experience in mastering tough cutting tool jobs.

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THE STANDARD LINE: *Drills • Reamers • Taps • Dies • Milling Cutters • End Mills • Hobs • Counterbores • Special Tools*

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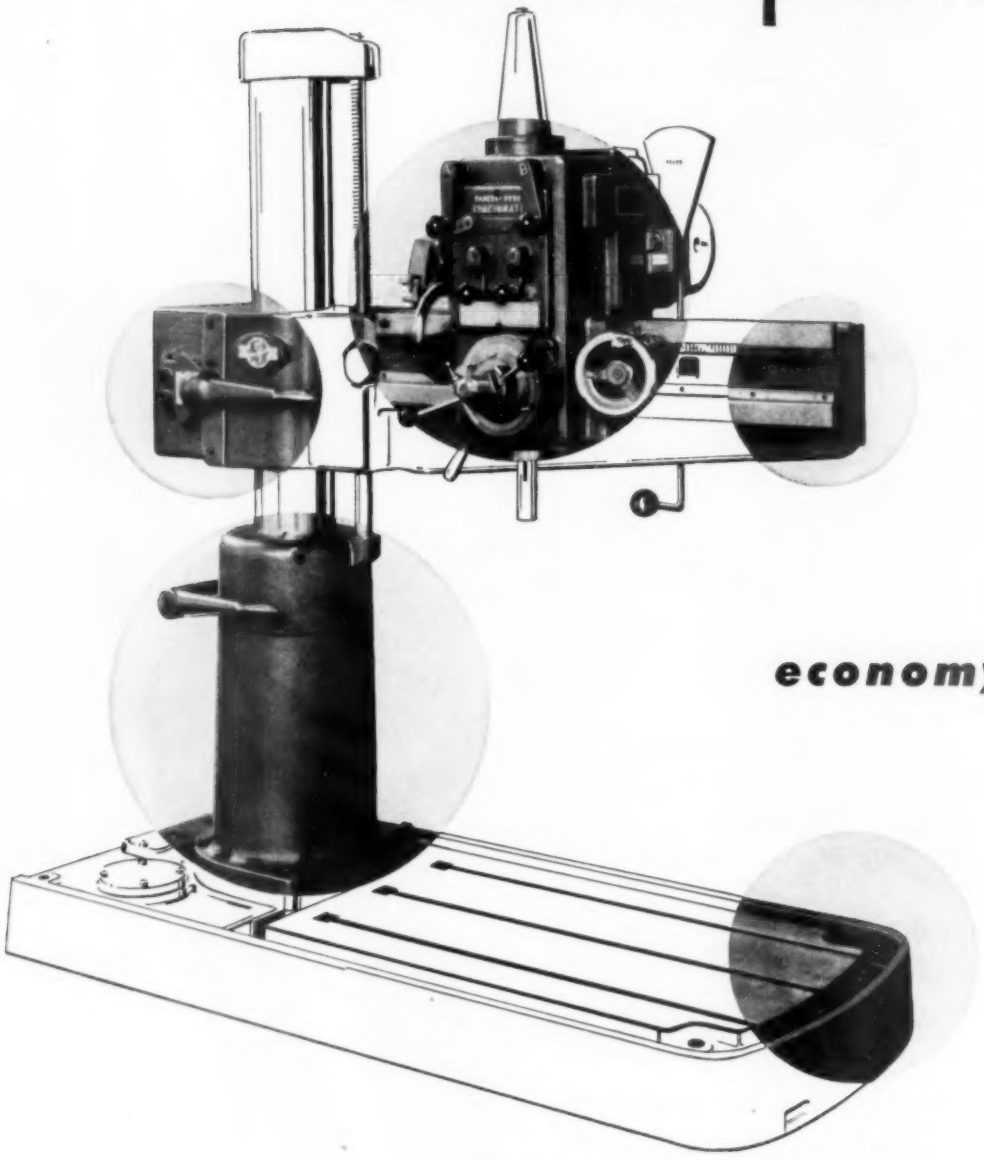

economy priced

The new Canedy-Otto **CINCINNATI ROYAL RADIAL** (3-foot arm, 7-inch column) has the features you need to handle up to 90% of your drilling requirements. It combines low cost with such high-priced radial features as: all-geared head, automatically pressure lubricated; 9 spindle speeds (30 to 1 overall ratio); 6 power feeds, flame hardened transmission gears . . . all shafts mounted on anti-friction bearings . . . ground tubular steel column mounted on two Timken tapered bearings . . . simple, trouble-proof column and arm clamps . . . hardened and ground head rail on arm . . . extra heavy base. Catalog CO-15 on request.

CANEDY-OTTO DIVISION

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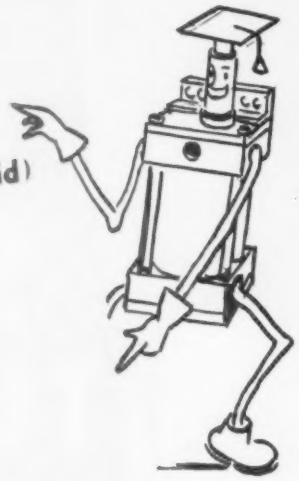
BOOST 80 PSI AIR

(Input Range: 40 to 3000 psi Air or Fluid)



TO . . . 2000 PSI HYDRAULIC PRESSURE

(Output Range: 200 to 10,000 psi Fluid)

with Miller

Fluid Pressure BOOSTERS

From ordinary plant air line pressure, Miller Boosters produce hydraulic pressures (from 200 to 10,000 psi) for driving one or more hydraulic work cylinders simultaneously at from 30 to 450 strokes per minute. Ordinarily, the booster operates one stroke for each stroke of the operated work cylinders.

Used in place of conventional type hydraulic pumps, Miller Boosters save space and weight, permit convenient portability and are easier and less costly to install, operate, and maintain. Also, they hold pressure *indefinitely —without the motion and heat generation of ordinary pump circuits.*

Used in place of air cylinders, the booster driven hydraulic work cylinder, which can do the work of an air cylinder ten times as large and heavy, saves space and weight at point of application of cylinder thrust—since the booster itself can be mounted separately—away from the hydraulic work cylinder—and either on or off the equipment or machine.

In many installations, the popular Miller Dual Pressure "Air Miser" Booster *saves up to 95% of the air* normally consumed by direct-driven air cylinders.

A wide selection of sizes, pressure ratios and mounting styles are available for the first time at low cost on a normal delivery schedule because Miller Boosters are built up from stock Miller standard cylinder parts to eliminate costly designs, patterns and castings.

Especially Recommended for . . .

- WELDING
- PUNCHING
- SHEARING
- CLAMPING
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- PRESSING

and SIMILAR APPLICATIONS

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OTHER MILLER PRODUCTS INCLUDE: AIR CYLINDERS, 1½" to 20" BORES, 200 PSI OPERATION; LOW PRESSURE HYDRAULIC CYLINDERS, 1½" TO 6" BORES FOR 500 PSI OPERATION, 8" TO 14" BORES FOR 250 PSI; HIGH PRESSURE HYDRAULIC CYLINDERS, 1½" TO 12" BORES, 2000-3000 PSI OPERATION. ALL MOUNTING STYLES AVAILABLE.

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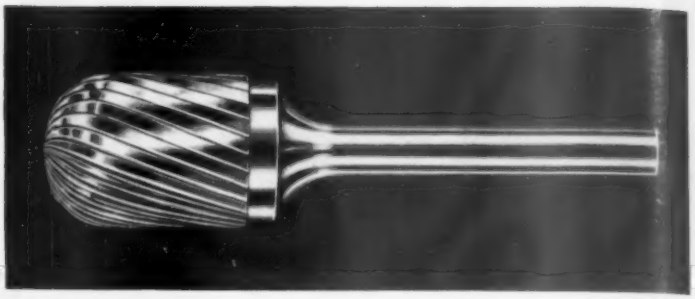
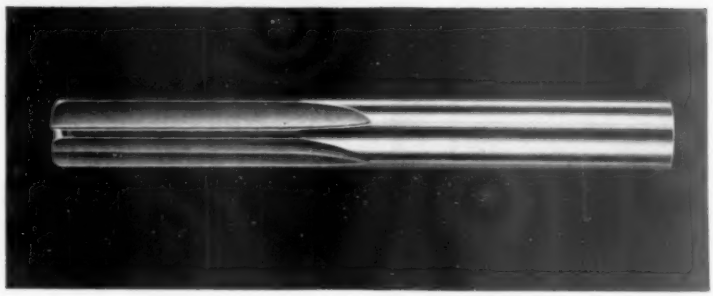
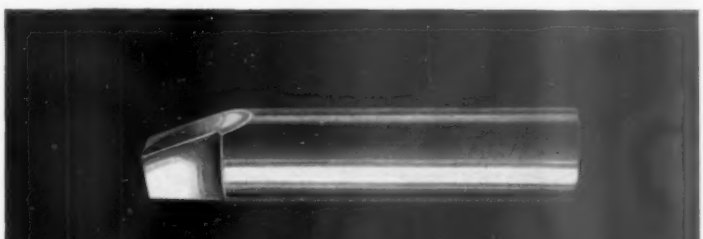


TUNGSTEN CARBIDE



PRECISION GROUND-FROM-THE-SOLID



Special precision machines bring you ground-from-the-solid TUNGSTEN CARBIDE Rotary Files, End Mills, Reamers, Drills, Boring Bits and many others.

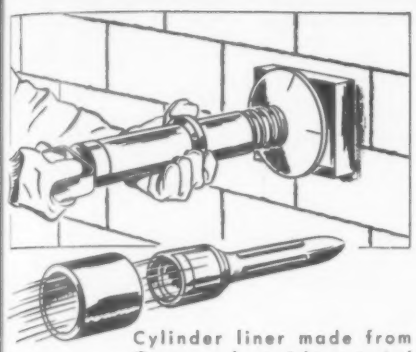
WRITE FOR OUR COMPLETE CATALOG NOW

THE ATRAX COMPANY
NEWINGTON IN CONNECTICUT

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributors: Bethlehem Steel Export Corporation



Cylinder liner made from Omega and, at right, a typical stud used in the Drive-It Tool.

Omega Tool Steel Takes 25-Ton Wallop in Novel Power Tool

Omega is our champion tool steel for cold-battering jobs, wherever there are heavy and repeated shocks.

In the Drive-It Tool, for example, it solved an unusual problem involving very heavy blows. This power tool, made by Powder Power Tool Corp., Portland, Ore., drives studs and rivets into concrete, masonry, even steel — eliminating drilling and hammering. It's fired by small-calibre cartridges, driving studs (made from Bethlehem Alloy Steels) as deep as 3 inches in concrete or through ⅝-inch steel.

Each type of stud used in the Drive-It Tool is designed so that a flange on its head is sheared off as the stud is shot through a cylinder liner pressed into the barrel. However, when liners began to crack under the stress of 25-ton blows, the makers realized that the oil-hardening tool steel they'd been using just didn't have enough shock-resistance.

Omega licked the trouble, thanks to its super toughness. Heat-treated to a hardness of Rockwell C-55 to C-57, the Omega liners put a stop to the breakage.

Omega is a tool steel engineered to take the heaviest shocks in its stride. Use it for tools and parts like these: punches, chisels, rivet busters, shear blades, swaging dies, gripper and vise jaws, clutch parts, calking tools, and knockout pins.

Its typical analysis:

C	Mn	Si	Mo	Va
.50	.70	1.85	.50	.25

Sand-Cored Holes Easy to Ream with 67 Chisel

A foundry reported poor results with reamers used to clean up holes for shafts and bearings in iron castings. Made with sand cores, the inside surfaces of the holes are extremely abrasive to ream because of adhering sand.

The small-diameter reamers they were using were made of carbon tool steel; these hardened through because of their small section. Consequently, they were brittle — and breakage was terrific. The cutting edges of the larger reamers, also made of carbon tool steel, stood up pretty well, but because many of the reamers were quite long, the heat-treatment caused them to warp out of line.

Then they tried using high-speed steel. Still no real improvement. Reaming costs remained a headache, and they wanted a solution fast.

We tackled the problem by suggesting the use of 67 Chisel, Bethlehem's chrome-tungsten grade of shock-resisting steel. We don't always come up with the right answer in a hurry, but in this case the recommendation proved just what was needed. The first trial was a big success. Subsequent use of reamers made from 67 Chisel left no doubts, and so the foundry folks are pretty happy with their new reamers.

The secret of this solution was in the carburizing of the tools by heating to 1750 F, packing them in a box with a carburizing compound and holding one hour at that temperature. This treatment resulted in a nice high-carbon case which varied in depth from .005 to .008 inches. The cutting edges have a high hardness, but still retain the tough, shock-resisting core (about .50 carbon) which is characteristic of Bethlehem's 67 Chisel.

Its typical analysis:

C	Si	Cr	W	V
.50	.75	1.15	2.50	.20

Our Tool Steel Engineer Says: *Carbon tool steels are safest when hardening produces a case and a core*

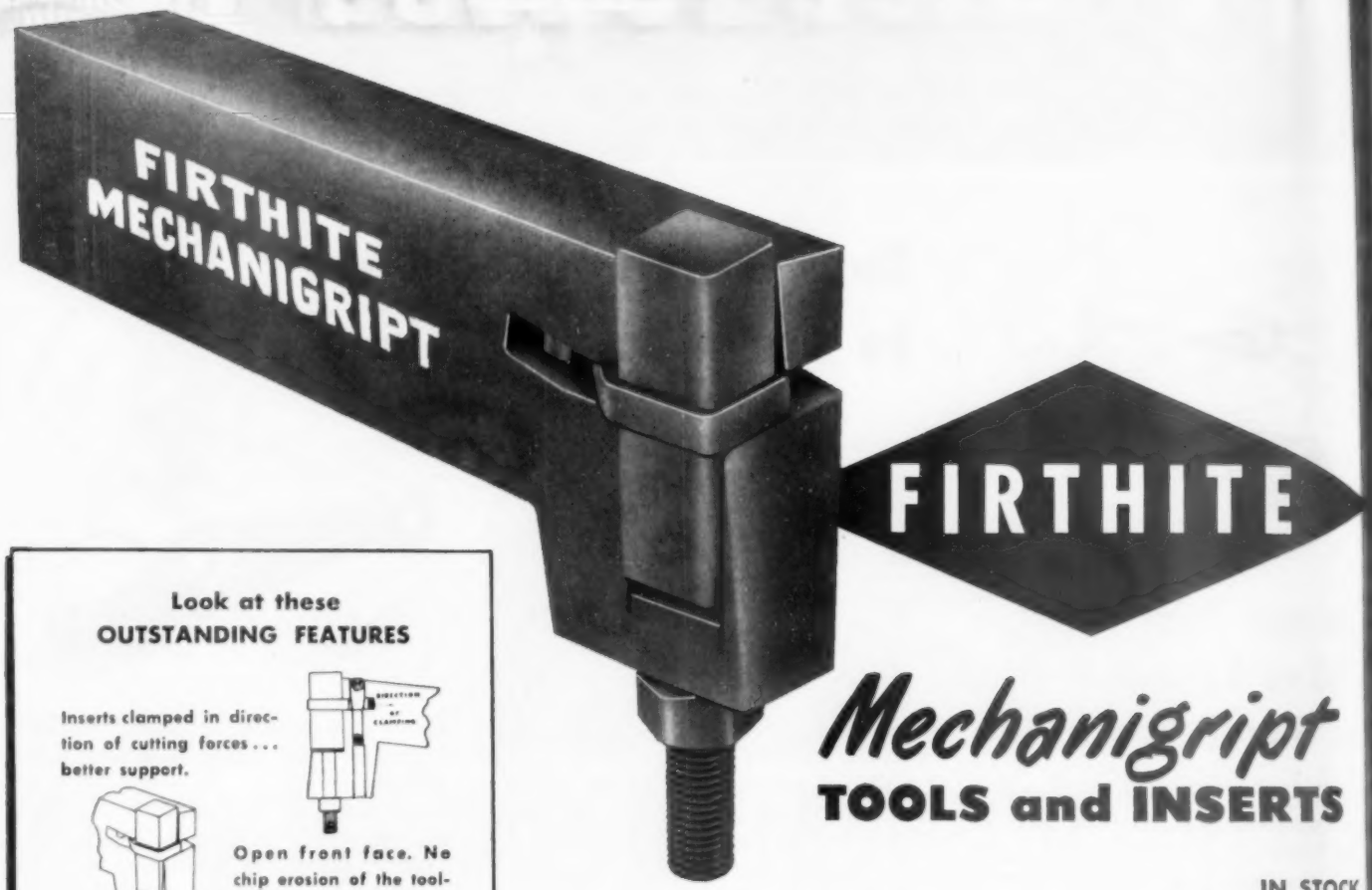
Carbon tool steels are normally used so they'll harden with a case and a core. If tool sections are small, usually less than ½ in., the tools will harden all the way through . . . without the formation of any core. This is dangerous because such tools are likely to crack in heat-treatment.

Even more likely to crack is the tool having one portion that hardens with a case and a core . . . and an adjacent section which hardens through. A ring die, for example, with a body large enough to harden with a case and core will invariably crack in heat-treatment *if* it incorporates a flange which is thin enough to harden through.

Manganese, oil-hardening tool steel — such as our popular BTR grade — is just the thing for tools having a design likely to cause cracking when made from carbon tool steel. Air-hardening tool steels provide the greatest safety of all.

Bethlehem ULTRASONIC TESTED **Tool Steel**

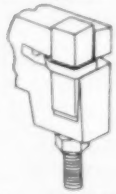
BUILT FOR *Extra* PERFORMANCE!



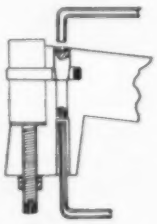
Mechanigript TOOLS and INSERTS

Look at these OUTSTANDING FEATURES

Inserts clamped in direction of cutting forces . . . better support.



Open front face. No chip erosion of the toolholder.



TOP or BOTTOM insert clamping and release . . . for conventional or inverted tool mounting.

Spring loaded insert clamp for QUICK, Easy insert removal.

ALSO—Takes ALL "industry-standard" sizes of inserts. Hardened Alloy steel accessories. No shank offset on the larger sizes.

Solid, heat-treated alloy steel shank. No brazed or welded sections.

IN STOCK

ALL of the design features required for high production tooling are incorporated in the Firthite Mechanigript Tools: 1. As many as eight single cutting edges can be used before regrinding the insert: 2. No tool removal from machine set-up for regrinding cutting edges: 3. Only one type of grinding wheel required for tool maintenance: 4. Toolholders re-usable indefinitely, inserts only are expendable.

FIRTH · STERLING TRADE MARK

Firth Sterling

STEEL & CARBIDE CORPORATION

General Offices: 3113 Forbes Street, P. O. Box 71, Pittsburgh 30, Pa.

Offices and Warehouses:*
Hartford, New York*, Philadelphia*, Cleveland, Dayton*, Detroit, Chicago, Birmingham*, Los Angeles.

R-235

PARKER • MAJESTIC PM PRECISION MACHINES

Above is pictured the home and products of the

PARKER-MAJESTIC, INC.

For over twenty-one years this company has manufactured the Parker Spindles used in Precision Grinding, Boring and Milling applications.

Supplementary products include the well known line of Parker-Majestic Internal, External, No. 2 Surface and Rotary Surface Grinders.

Descriptive literature upon request.

PARKER-MAJESTIC, INC.

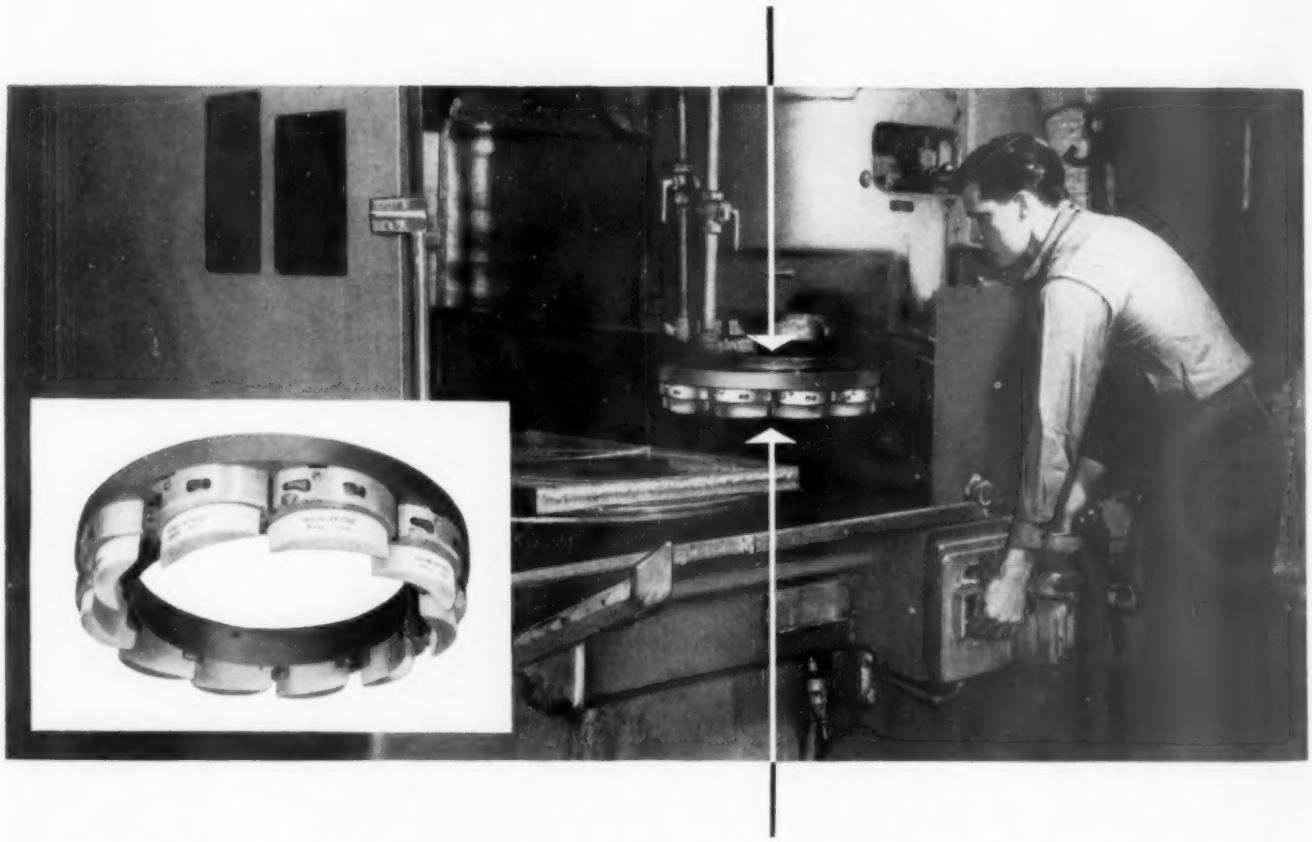
formerly MAJESTIC TOOL & MFG. CO.

147 JOS. CAMPAU • DETROIT 7, MICHIGAN

New

TITCOMB SEGMENTAL CHUCK

SLASHES GRINDING COSTS



Check the many advantages of this revolutionary new chuck when it is used in combination with tried and proved Robertson Segments . . .

LOW COST. Novel design of segment gives the lowest cost per cubic inch of usable abrasive. By actual grinding tests, three to four inches of metal are removed for every inch of abrasive loss.

FASTER CUTTING. Unique design produces a plowing action. This, plus centrifugal force, sweeps chips and dirt from the work surface.

CONTINUOUS CUTTING. Overlapping segments assure continuous cutting . . . leave plenty of space for chip clearance.

LESS WASTE. Clamping device with safety wedge action and integral segment adjusting plate reduces segment waste. No special skill is required to load the holders.

SIMPLIFIES BUYING. Regardless of the size of the chuck, one size segment covers all vertical spindle surface grinding requirements.

If you are now using Robertson Wheels or Segments, you know you can count on them for top performance. Even so, you will be surprised at the greater production with less cost that this new chuck can give you. If you are one of the few who have yet to experience the tremendously increased output that comes from using Robertson abrasive products, then you owe it to yourself to investigate the possibilities which this new combination offers you. Let a Robertson engineer show you—right in your own plant—on your own equipment. Write on your business letterhead for a demonstration.

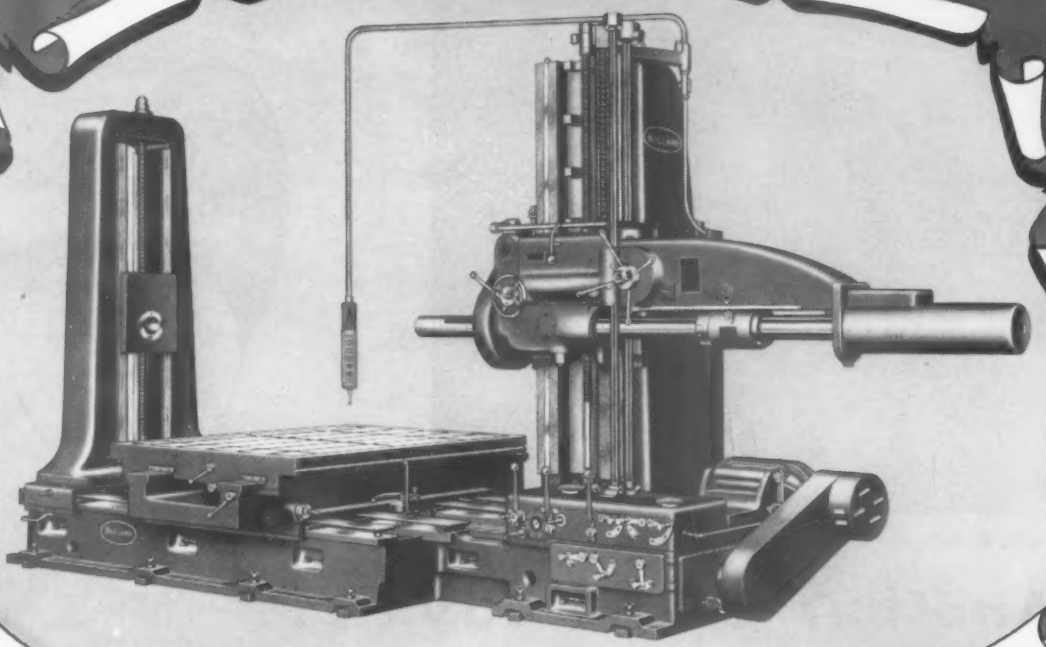
Today, some of the country's largest manufacturers are using Robertson Wheels and engineering services.

ROBERTSON MANUFACTURING COMPANY

TRENTON 5, NEW JERSEY

Resin-Bonded and Vitrified-Bonded Grinding Wheels • Mounted Wheels • Segments

NOW — 4 WAY Bed Construction



BULLARD

HORIZONTAL BORING MACHINE

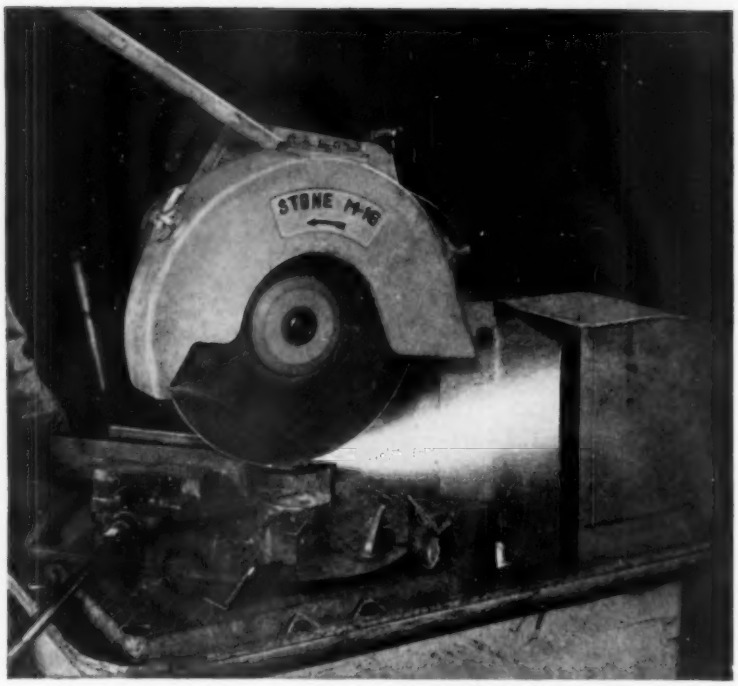
In addition to the Bullard 4-way bed construction, other design improvements such as protected bed-ways, non-metallic bearing surfaces under table and saddle, and adjustable nuts for table and saddle feed screws are a few of the improvements that place these 4" and 5" spindle machines on your list for investigation.

Furthermore, don't forget—convenient right hand operation, safety features and hydrodynamic drive.

Write Bullard for other details

THE BULLARD COMPANY

BRIDGEPORT 2, CONNECTICUT

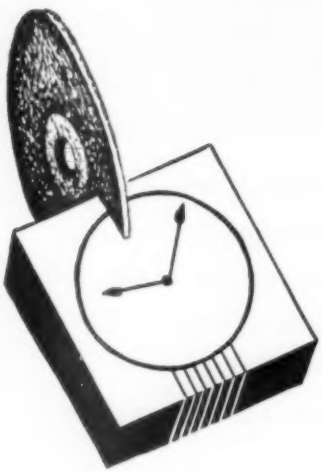


16"x⅛" Grade 211 Manhattan Cut-Off Wheels in use at Falls Metal Works, Little Falls, N.J.

Another Cost Study . . .

shows MANHATTAN CUT-OFF WHEELS

Cuts Hours and Dollars



Users at Falls Metal Works say, "Manhattan Cut-Off Wheels greatly reduce our costs of cutting on structural steel and bar stock. When you consider our work involves considerable miter cutting, these wheels are really doing an outstanding job for us".

This is no surprise to Manhattan engineers because they always custom-tailor the construction of Manhattan Cut-Off Wheels to the specific requirements of the work to be done. In effect, you get individualized wheels when you order Manhattan.

LET THE MANHATTAN ABRASIVE WHEEL DEPARTMENT HELP YOU CUT COSTS

Submit your problems and samples of work to Manhattan's laboratory. It is equipped for nearly every kind of abrasive cutting test.

ABRASIVE WHEEL DEPARTMENT

MANHATTAN RUBBER DIVISION

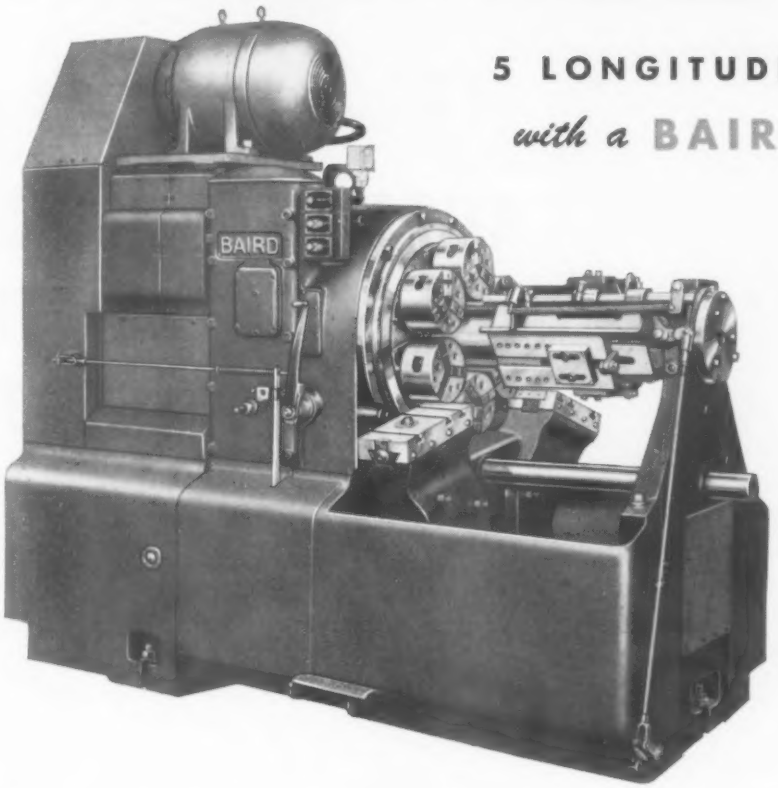
RAYBESTOS-MANHATTAN, INC. **PASSAIC, N. J.**

Mechanical Rubber Products • Rubber Covered Equipment • Abrasive and Diamond Wheels • Packings • Brake Linings
Brake Blocks • Clutch Facings • Radiator Hose • Fan Belts • Asbestos Textiles • Powdered Metal Products • Bowling Balls

RM

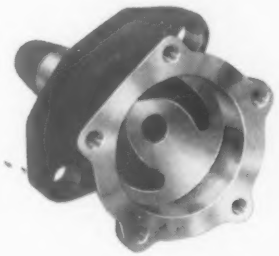
ASK **BAIRD** ABOUT IT!

HIGH PRODUCTION TOOLING

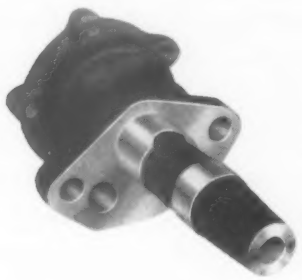


5 LONGITUDINAL, 5 CROSS SLIDES *with a* BAIRD *automatic* CHUCKER

MACHINING A CAST IRON OIL PUMP BODY



1ST OPERATION: Face flange, finish counterbore I D and depth, cut groove in flange, drill and tap 5 29/64" holes. Work held stationary for drilling and tapping . . . OTHERWISE WORK ROTATES. Production: 308 pieces per hour.



2ND OPERATION: Face and turn shank end, undercut spot drill and drill center hole thru to cored section, turn OD of shank, ream center hole, drill 2 13/32" holes. Production: 222 pieces per hour.

Completely Automatic Operations . . . Hands Free

THE OPERATOR of a Baird 7", 6 spindle horizontal chucking machine likes his job. The open construction gives him easy access to all tooling . . . fast set-up. The automatic mechanism that operates the chucks does away with chucking levers, valves and gages . . . leaves both hands free. Reliable mechanical and electrical safety devices protect him, his machine, and the work. He clearly sees the advantages of independently operated tool slides, many combinations of spindle speeds and the means to mill and cross mill. He's proud of his accomplishments for every shift.

THE PRODUCTION MANAGER likes the way the time sheets read (note this typical job). You can't go far wrong with such production.

MANAGEMENT, that makes the investment in Baird high production machinery, sees the favorable financial returns . . . the many profitable operating years of the Baird 7.6H Chucker . . . the machine that keeps young in performance, even when it becomes old in years.

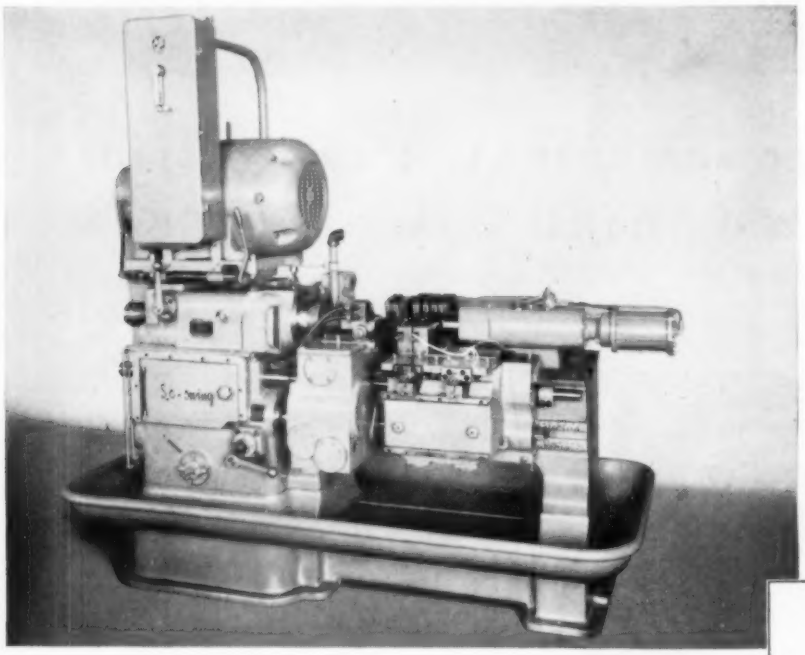
FULL DETAILS AND BULLETIN ON REQUEST

the **BAIRD MACHINE COMPANY**
STRATFORD • CONNECTICUT

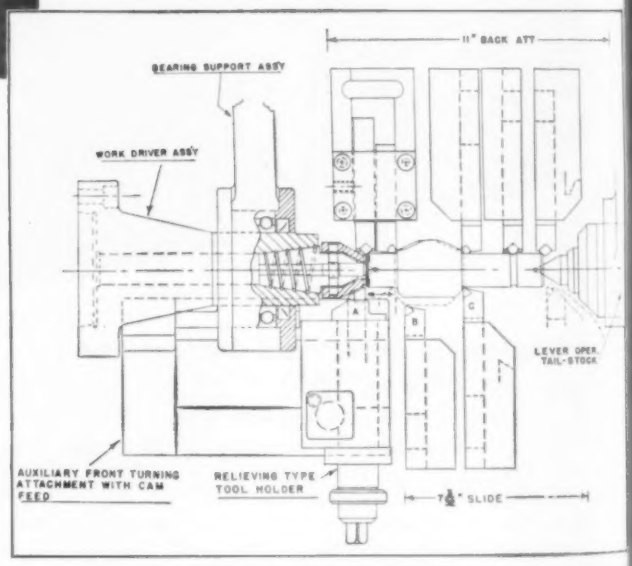
AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE *Lo-swing* PEOPLE" SENECA FALLS, NEW YORK



MODEL "LR" *Lo-swing* TURNS BOTH ENDS OF GEAR SHAFTS IN ONE OPERATION



Problem: Turn, square and chamfer both ends of Gear Shafts in a single operation.

Solution: The Model "LR" Automatic *Lo-swing* Lathe selected for this job was equipped with one standard two-slide front turning carriage, one 11" wide back squaring attachment and one special auxiliary front turning attachment arranged for feeding towards the tailstock. Tools A-B and C, as shown in the line drawing, start cutting simultaneously. Tool A feeds in the direction of the tailstock to the position shown by dotted lines, and then returns to the starting position before tools B & C, which feed towards the headstock, reach the end of their cut. All shoulders are faced and chamfered and one diameter grooved immediately after the front tools have ceased cutting. All slide movements are cam operated and cannot get out of time.

A spindle extension which runs in its own bearing, provides sufficient space for the auxiliary front turning attachment. Note also the balanced driver with two tongues which fit into a groove in the end of the gear shaft providing an efficient method of driving the gear shaft.

Seneca Falls engineers welcome inquiries involving difficult and unusual machining problems.

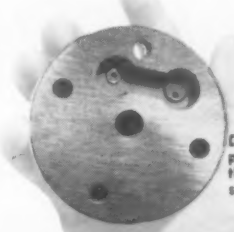
SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

PRODUCTION COSTS ARE LOWER WITH *Lo-swing*

More Production—*Yes...*

a Better Finish—*Too...*

with BESLY GRINDERS!



Diameter of end plates is 3⅛"x.561" thick — practically a solid area.

Case Facts on This Grinding Operation

Work is held to .00005" for flatness . . . and parallel to within .0005" — with a surface finish of 10 micro-inches or better.

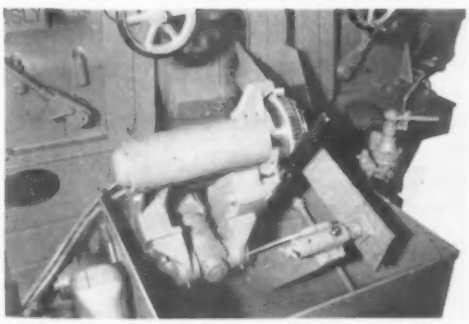
Uniform flatness of work as it comes from the grinder eliminates necessity for a subsequent lapping operation.

Parts come to the grinder with .002-.003" overall stock for final grind. Production is 180 finished pieces per hour — a total of 360 surfaces.

Grinder is equipped with a filter unit to remove all foreign matter from the coolant.

No. 226 — 23" Besly Double Spindle Wet Grinder equipped with hydraulically-oscillated indexing type fixture and hydraulic infeed on the spindles

In grinding cast iron cylinder end plates for NORGE REFRIGERATORS, this Besly Grinder turns out more finished pieces per hour than any equipment used previously. At the same time, the work is finished so accurately that a subsequent lapping operation has been eliminated. Such outstanding performance pays off in lower production costs for an *improved product.*



Hydraulically-oscillated indexing-type fixture — with hydraulic infeed on the spindles — is adjustable to change rate of oscillations.

Whatever your product — if precision-ground surfaces are essential — Besly may be able to point out how increased production can be achieved at lower unit cost. Consultation with a Besly engineer does not obligate you.

BESLY-TITAN WHEELS! Ask for a copy of this new Besly-Titan booklet of abrasive wheels and discs—a valuable source of information on modern grinding abrasives—up-to-date—authoritative. Write for your copy today!

WRITE TODAY!

BESLY

TAPS — the world's most accurate tap.

TWIST DRILLS AND REAMERS —Complete line for every need.

BESLY-TITAN ABRASIVE WHEELS AND DISCS— individually formulated for your job.

GRINDERS that reduce costs on every type of surface grinding

CHARLES H. BESLY & COMPANY ● FACTORY: BELOIT, WISCONSIN

"no more GAMBLING on tool steel selection"

[⅓ actual size; Selector is in 3 colors]

Since the first announcement, hundreds of tool steel users have received their CRUCIBLE TOOL STEEL SELECTORS. The comments received indicate that this handy method of *picking the right tool steel right from the start* is going over big.

"Handiest selector I've ever seen"

"No more gambling on tool steel selection"

"You're right, the application should dictate the choice of the tool steel" . . . and many, many more favorable comments.

You'll want your CRUCIBLE TOOL STEEL SELECTOR. It uses the only logical method of tool steel selection—begin with the application to pick the right steel! And the answer you get with one turn of the Selector dial will prove satisfactory in every case, for the CRUCIBLE TOOL STEEL SELECTOR covers 22 tool steels which fit 98% of all Tool Steel applications. ALL the tool steels on the Selector are in Warehouse Stock . . . that means when you get the answer, you can get the steel . . . fast!

Write for your Selector today! We want you to have it, because we know you've never seen anything that approaches your tool steel problems so simply and logically. Just fill out the coupon and mail. Act now! CRUCIBLE STEEL COMPANY OF AMERICA, Chrysler Building, New York 17, N. Y.

Here's how it works:

To use the Selector, all you need know is the characteristics that come with the job: type and condition of material to be worked, the number of pieces to be produced, the method of working, and the condition of the equipment to be used.

FOUR STEPS—and you've got the right answer!

1. Move arrow to major class covering application
2. Select sub-group which best fits application
3. Note major tool characteristics (under arrow) and other characteristics in cut-outs for each grade in sub-group
4. Select tool steel indicated

That's all there is to it!

Here's an example:

Application—Deep drawing die for steel

Major Class—Metal Forming—Cold

Sub-Group—Special Purpose

Tool Characteristics—Wear Resistance

Tool Steel—Airdi 150

One turn of the dial does it!

And you're sure you're right!!

Crucible Steel Company of America
Dept. T, Chrysler Building
New York 17, N. Y.

Gentlemen:

Sure! I want my CRUCIBLE TOOL STEEL SELECTOR!

Name_____ **Title**_____

Company_____

Street_____

City_____ **State**_____

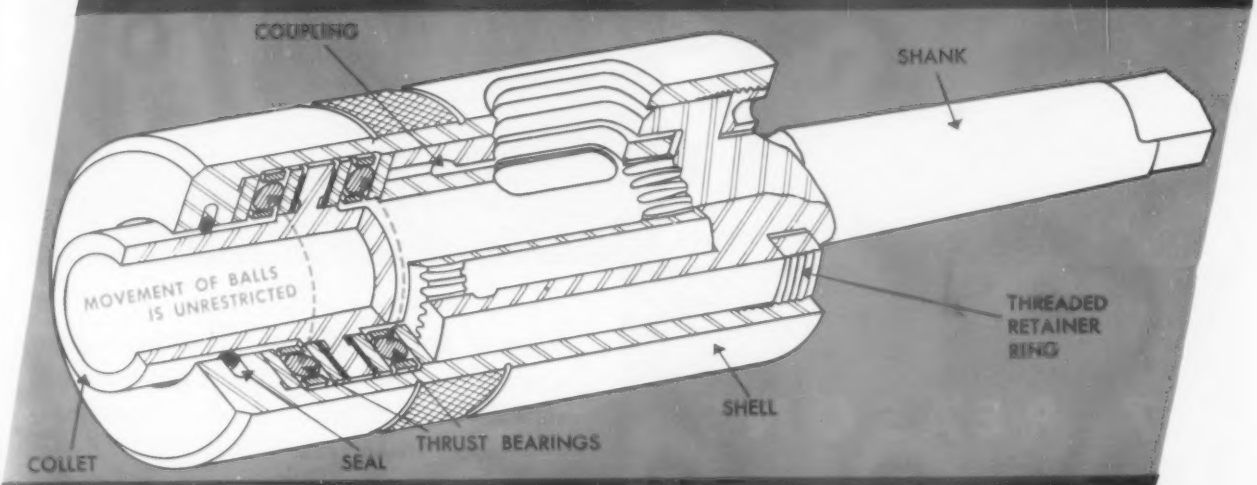
CRUCIBLE first name in special purpose steels

TOOL STEELS

fifty years of Fine *steelmaking*

Branch Offices and Warehouses: ATLANTA • BALTIMORE • BOSTON • BUFFALO • CHARLOTTE • CHICAGO • CINCINNATI • CLEVELAND • DENVER • DETROIT HOUSTON, TEXAS • INDIANAPOLIS • LOS ANGELES • MILWAUKEE • NEWARK • NEW HAVEN • NEW YORK • PHILADELPHIA • PITTSBURGH • PROVIDENCE ROCKFORD • SAN FRANCISCO • SEATTLE • SPRINGFIELD, MASS. • ST. LOUIS • SYRACUSE • TORONTO, ONT. • WASHINGTON, D. C.

for ACCURATE drilling • reaming • tapping



Use SJ SCULLY-JONES "JA" FLOATING HOLDERS

Get these advantages . . . *proven in the field:*

UNIFORM CUTTING OPERATIONS

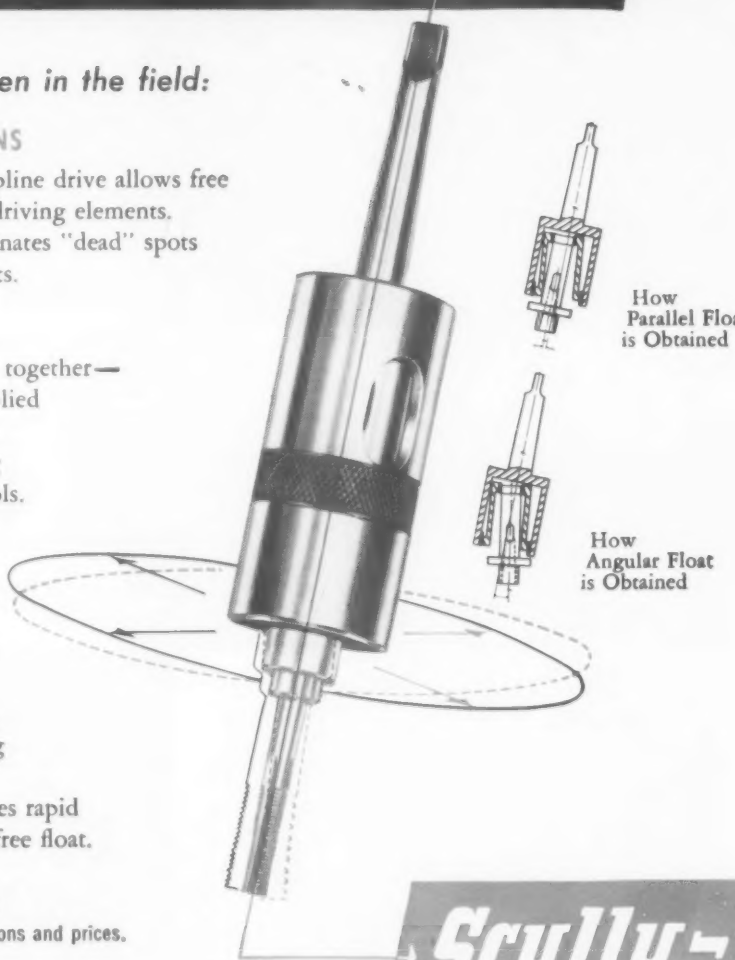
Clearance in the double-gear spline drive allows free movement of the floating and driving elements. This prevents binding and eliminates "dead" spots or zones which often cause rejects.

CONTINUOUS PRODUCTION

Two thrust bearings—placed close together—minimize the effect of the force applied on the tool by the hole. Thus, tools float freely into alignment—reducing down time and damage to cutting tools.

TROUBLE-FREE OPERATION

Balls are free to move in the required direction or rotate around the collet, because the floating element is separated from the drive. Free movement of the balls eliminates confined reciprocating motion. This greatly reduces the scrubbing action characteristic of small rocking movements. The scrubbing action often causes rapid destruction of ball-thrust plates and prevents free float.



How Parallel Float is Obtained

How Angular Float is Obtained

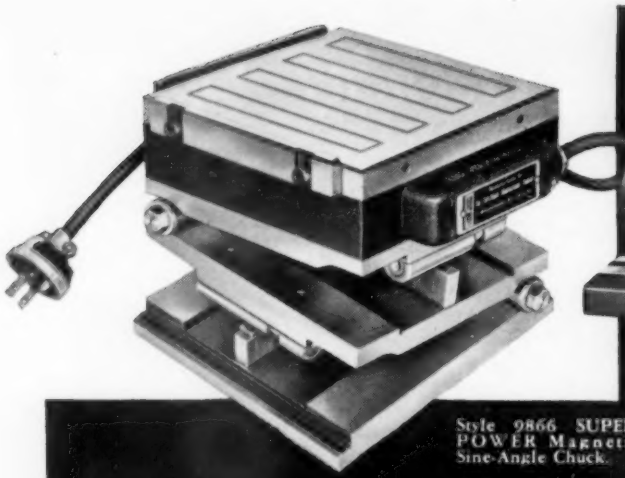
Write for Bulletin No. B-50
showing complete range of sizes, specifications and prices.

Scully-Jones AND COMPANY

1915 S. ROCKWELL ST., CHICAGO 8, ILLINOIS

R5467

YOU GET LOW COST, FAST, ACCURATE PRODUCTION WITH OUR STANDARD AND SPECIAL TOOLS



Style 9866 SUPER-POWER Magnetic Sine-Angle Chuck.

Style 510 Swivel Base SUPERPOWER Magnetic Chuck.

7 REASONS WHY

You Can't Beat a T-P Chuck

Whether you buy one of Taft-Peirce's many standard models or have one custom-made — all T-P SUPERPOWER Magnetic Chucks offer you these 7 advantages:

1. More Holding Power — size for size
2. Faster Setups
3. Greater Working Surface
4. Low Magnetic Losses
5. Rugged, Rigid, One-Piece All-Steel Body
6. Waterproof and Shockproof Construction
7. Generous Safety Factors

Contact your local Taft-Peirce representative for more details. He'll be glad to help you select the chuck best suited to your needs.

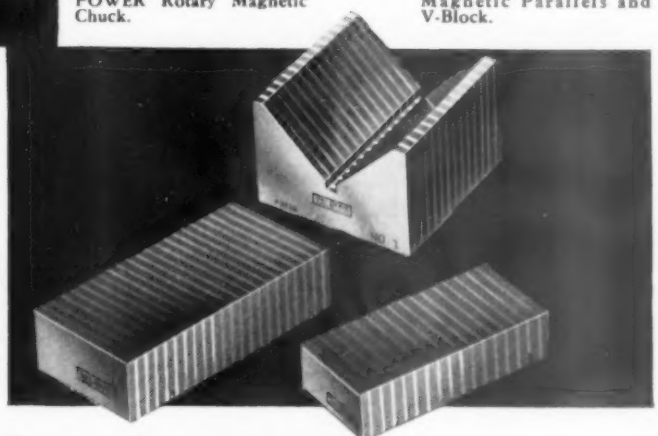
The Taft-Peirce Mfg. Co.

WOONSOCKET RHODE ISLAND

Left: Style 618 SUPERPOWER Magnetic Chuck.

Bottom Left: 16" SUPER-POWER Rotary Magnetic Chuck.

Below: SUPERPOWER Magnetic Parallels and V-Block.



TP means TOP PRECISION

"DURACUT ABRASIVE DISCS ARE TERRIFIC!"*

**This is typical of what hundreds of weld grinders and maintenance men are saying about these new flexible abrasive discs.*

For use on portable disc sanders, DuraCut abrasive discs are 1/8" thick while the ordinary coated discs have but a single layer of abrasive. The extra cutting ability offers these startling advantages:

- **Greater economy.**
- **Longer life — 15 to 20 times.**
- **Faster, sustained rate of cut.**
- **Safe — strong — resist tearing.**
- **Increased labor savings — less disc changing.**
- **Available in a wide range of grits, grades and structures — permit control over rate of cut and finish.**

TYPICAL APPLICATIONS: Blending and finishing of steel, stainless and alloy steel welds . . . Removing rust and scale . . . Finishing sheet metal jobs . . . Cleaning weld spatters.

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Order Today for a Trial.

Sizes available for immediate shipment . . .
7 x 1/8 x 7/8
9 x 1/8 x 7/8
} In any of these grit sizes: 36, 54, 80

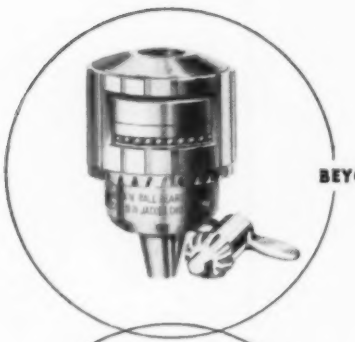
BAY STATE ABRASIVE PRODUCTS CO., Westboro, Mass.

Branch Offices and Warehouses — Chicago, Cleveland, Detroit, Pittsburgh
Distributors — All principal Cities
In Canada: Bay State Abrasive Products Co. (Canada) Ltd., Brantford, Ontario

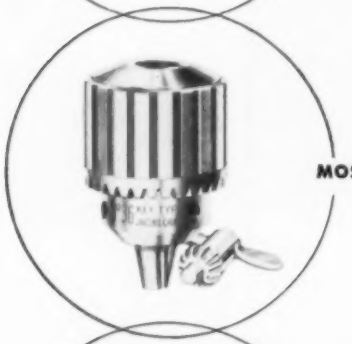
Top Performance Consistently Duplicated

FOREMOST IN CHUCKS.. F

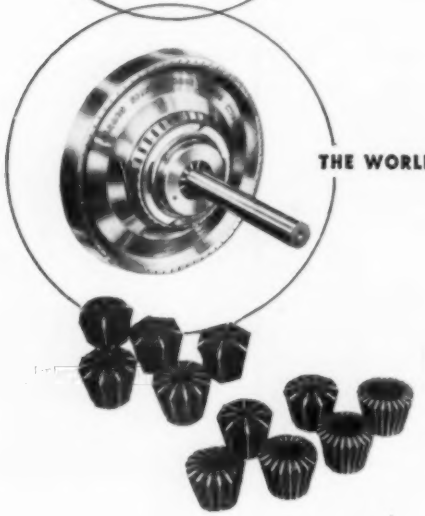
Unmatched For Accuracy And Gripping Power, Jacobs Chucks Are Vital Links Between Power Tools And The Finished Job



BEYOND ALL COMPARISON. Say "Jacobs Ball Bearing Super Chuck" and you've mentioned the last word in drill chucks. No other chuck ever made compares with this blue-chip wonder — in which Jacobs' famous ball bearing construction, tough alloy steels and precision workmanship combine for the tightest practical grip and great accuracy. That's why the Jacobs Ball Bearing Super Chuck is tops throughout the world for heavy-duty drilling.



MOST WIDELY USED DRILL CHUCK IN THE WORLD. Made of the same rugged materials and to the same close tolerances as the Jacobs Ball Bearing Super Chuck, the Jacobs Plain Bearing Chuck is particularly designed for portable tools and light and medium duty drill presses and lathes. Because of its matchless gripping power and accuracy it has been incorporated as standard equipment by the overwhelming majority of portable tool users both here and abroad.



THE WORLD'S OUTSTANDING LATHE COLLET CHUCK. Introduced less than two years ago, the Jacobs Spindle Nose Lathe Chuck has already gained sensational acceptance. Users who want the very best in machine tool performance are insisting on this chuck — thanks to its many improved features, including advantages never before obtainable in collet equipment. For example, there's the amazing capacity range of its collets, each of which closes through a full $\frac{1}{8}$" range without the slightest loss of accuracy or gripping power. And only eleven Jacobs Rubber-Flex Collets are required to chuck bars of any diameter between $\frac{1}{16}$" and $1\frac{3}{8}$" — assuring exceptional savings over the cost of conventional chuck-and-collet equipment.

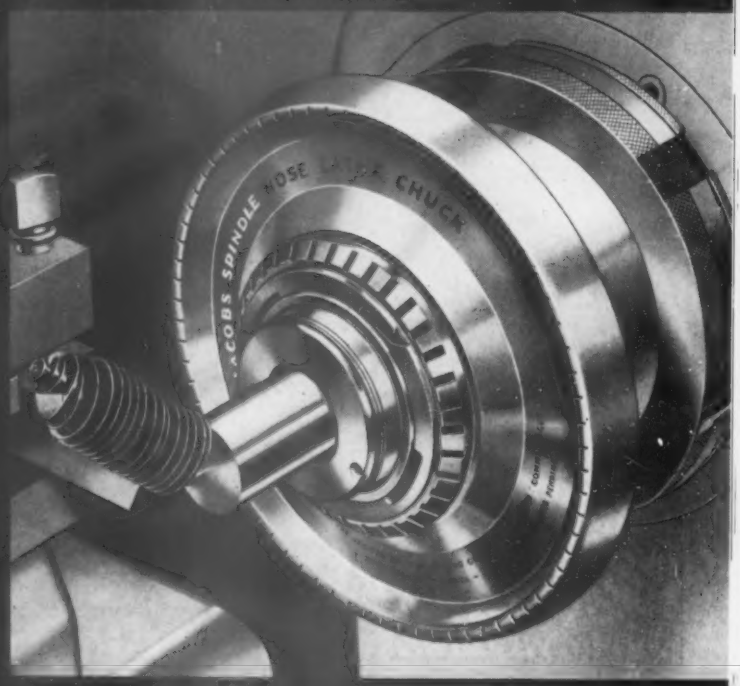
THE JACOBS MANUFACTURING COMPANY
45 Jacobs Road, West Hartford 10, Connecticut

FIRMEST IN GRIP

Jacobs Ball Bearing
Super Chuck

Jacobs Plain Bearing
Chuck

Jacobs Spindle Nose Lathe Collet Chuck

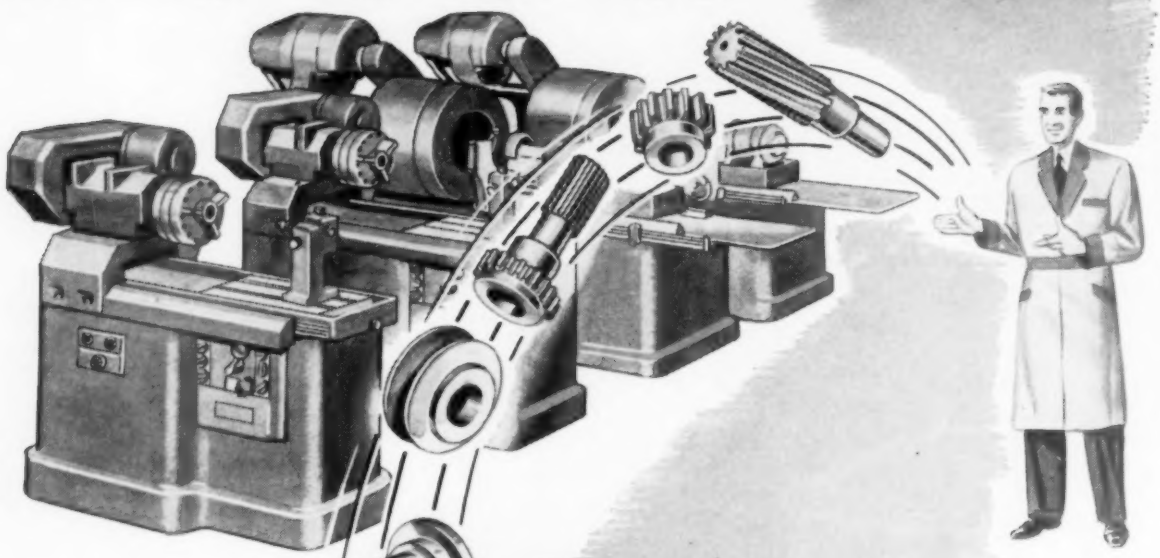


IF IT'S A

JACOBS

IT HOLDS!

WOODWORTH



Pitch your problem to US... We'll "Chuck" it Back!

Woodworth Diaphragm Chucks and Arbors are specially designed and engineered to suit your particular processing problems. They are recommended by America's finest machine tool builders. When processing that new job consider the best I.D. and O.D. chucking method. Consider Woodworth.

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super finish reduces wear to a minimum

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100% concentricity and hardness tests assure accuracy

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UNIVERSAL ENGINEERING COMPANY
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FOR PUNCHING MILD STEEL UP TO 1/8" THICK
8th Edition CATALOG C
WALES Type "C" HOLE PUNCHING UNITS
INCLUDING TYPE "E" AND "EJ" UNITS
3rd Edition CATALOG CD
WALES Type "CD" HOLE PUNCHING UNITS
FOR PUNCHING MILD SHEET METAL UP TO 1/8" THICK
2nd Edition CATALOG CJ
WALES Type "CJ" HOLE PUNCHING UNITS
FOR PUNCHING MILD STEEL UP TO 1/4" THICK
BULLETIN G
WALES Type "G" HOLE PUNCHING UNITS
FOR PUNCHING UP TO 1/2" THICK MILD STEEL
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WALES NOTCHING UNITS
FOR NOTCHING MILD STEEL UP TO 1/4" THICK
THE GROWTH OF AN IDEA THAT HAS REVOLUTIONIZED TOOLING PRACTICE

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Specialists in Punching and Notching Equipment

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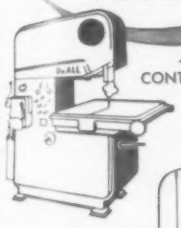
INDUSTRY'S NEW SET OF TOOLS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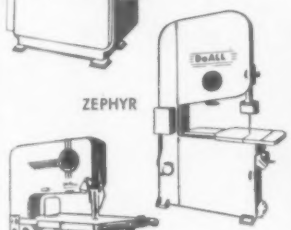
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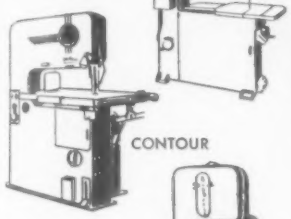
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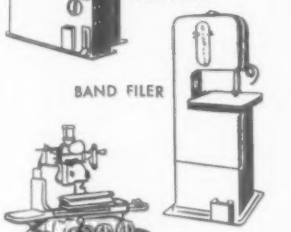
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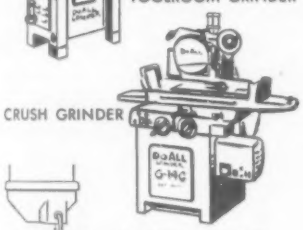
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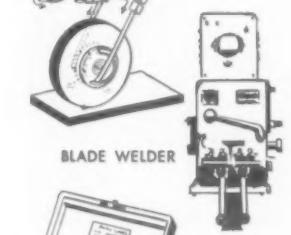
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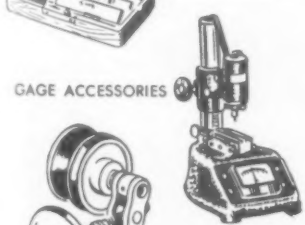
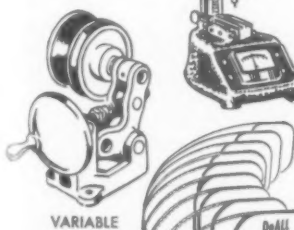
GAGE BLOCKS


GAGE ACCESSORIES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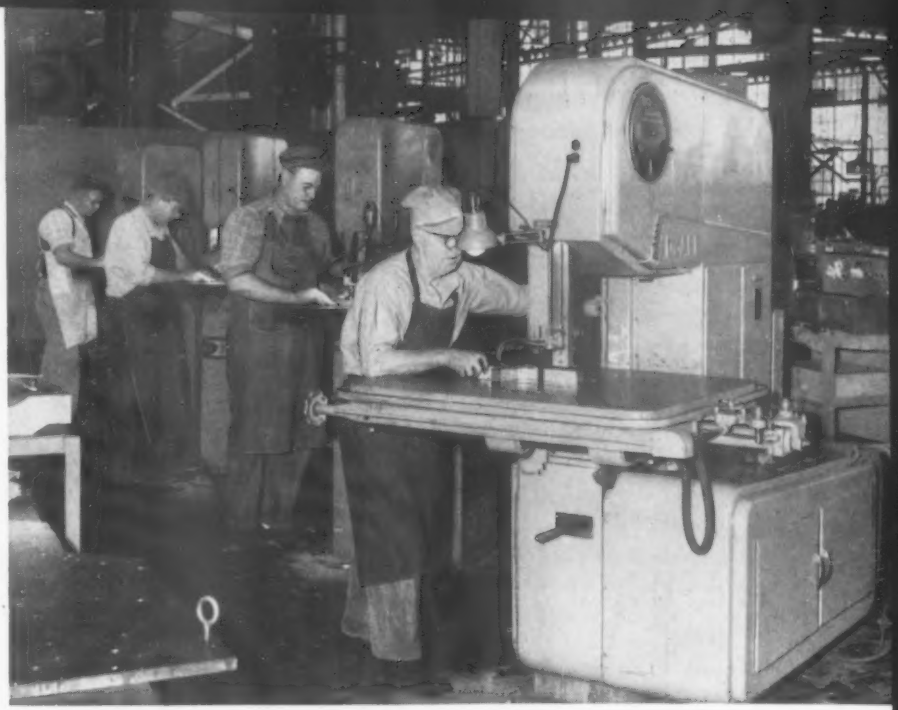

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Today's most versatile metal-working Band Machine Tool . . .

Wider speed range, hydraulic operation and variety of specially developed cutting tools adapt it to modern production work on any type of material in every industry.

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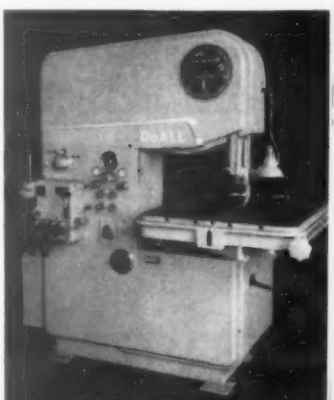
By shaping material directly to a layout line, the DoALL Contour-matic conserves critical material and man power.

GET THE PROOF from a demonstration in your own plant. Phone your DoALL Service Store today or write . . .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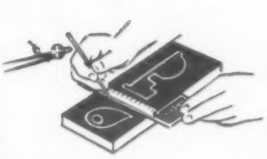
The first band machine tool with hydraulic operation.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This new FREE booklet tells how two new types of Oakite-developed solvent detergents make it easier and cheaper for you to do many difficult metal-cleaning jobs. Here are some of the subjects covered in the booklet:

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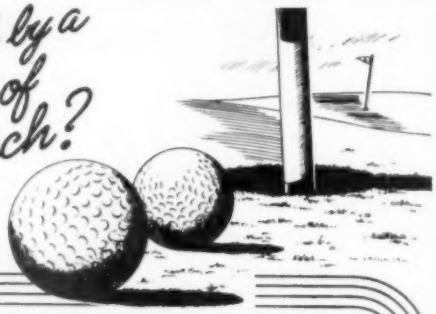

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THERE IS AN AMES INDICATOR OR GAUGE FOR VIRTUALLY EVERY MEASURING PROBLEM

Today increased production is the keynote of the nation's industrial plants. Outmoded inspection methods slow down the effort. Perhaps Ames can assist you. Ames full line of micrometer dial indicators and micrometer dial gauges plus their unequalled design and engineering ability, offers you the solution to practically any measuring problem controlling quality of process or product you may have. Ames experience includes the successful solution of out-of-the-ordinary problems such as the checking of chatter in grinding, the thickness of potato chips, the stretch of bolts as well as the everyday quality control problems of industry. Call on Ames today — the service is yours for the asking. Don't let production be stalled by outmoded inspection methods.

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LAPOINTE

"H-P" SERIES Horizontal Broaching Machines

Designed with longer strokes (30-inch to 78-inch), the "H-P" Series offers a wide range of sizes all the way from 2½ Ton to 50 Ton capacity.

This rugged, powerful LAPOINTE Horizontal Broaching Machine embodies a **hydraulic system** that assures smooth operation under varying load and speed conditions. It is amazingly versatile . . . it will handle any type of internal broaching and many types of surface broaching.

We earnestly suggest that you **write today** for the new "H-P" Bulletin containing engineering data and complete specifications.

JUST ASK FOR BULLETIN HP-5

Electrolized **BROACHES**

Lapointe Broaching Tools can be treated by our exclusive Electrolizing process, for longer life. If you are not acquainted with this process, ask us for information.

can take FULL RESPONSIBILITY for all your broaching requirements:

MACHINES, FIXTURES, AND TOOLS!

We don't take you part way — we engineer the complete job, *all the way through.* This eliminates divided responsibility. . . it guarantees *successful results.*

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HUDSON, MASSACHUSETTS - U. S. A.

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THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHES AND BROACHING MACHINES

Versa-Mil can give you

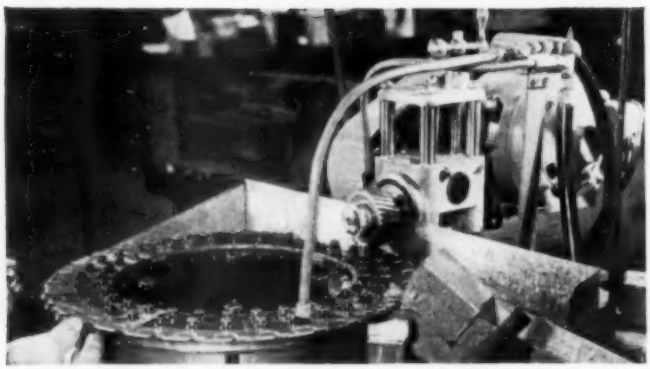
EXTRA MACHINE TOOL CAPACITY

PROMPTLY...

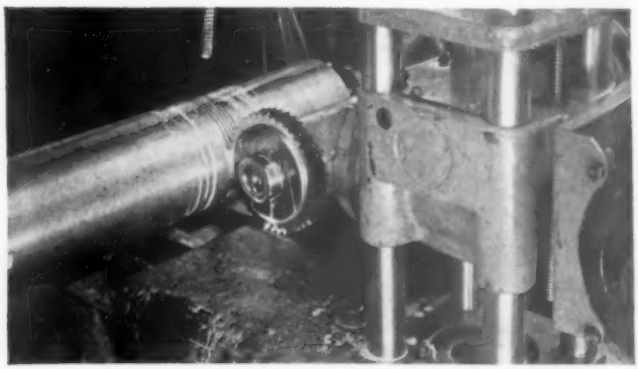
● VERSA-MIL provides an immediate, low-cost solution to many machining problems. You need not wait for additional new machine tools to meet many of your present machining needs.

A rugged, direct-powered tool built to precision machine tool standards, VERSA-MIL gives you a wide range of machining when combined with machine tools or fixtures: positioning at any angle with micrometer accuracy; 26 milling and boring speeds from 44 to 5500 rpm; 28 grinding speeds from 3000 to 18,000 rpm.

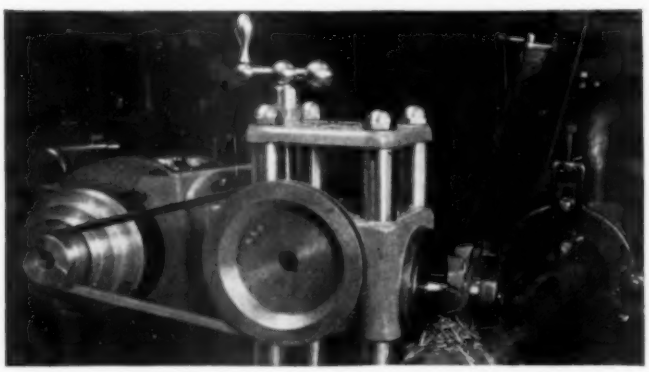
New Bulletin No. 6 illustrates how VERSA-MIL solves many machining problems—saves time and money. Write for your copy. VERSA-MIL COMPANY, 30 Church Street, New York 7, N. Y.



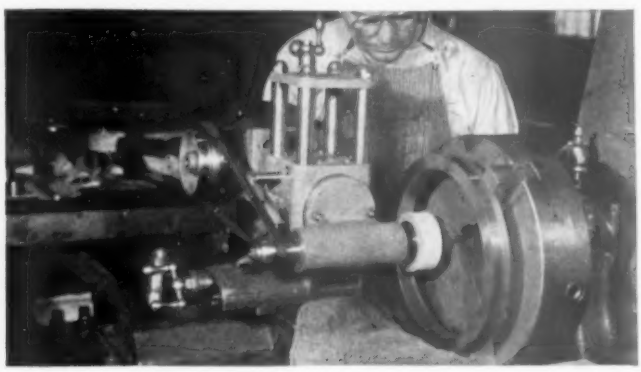
PRODUCTION INCREASED 150%! A motor drive for a rotary table, a work-holding plate, the frame of a discarded drill press, and VERSA-MIL, make a continuous miller for thread inserts for Heli-Coil Corporation of Long Island City.



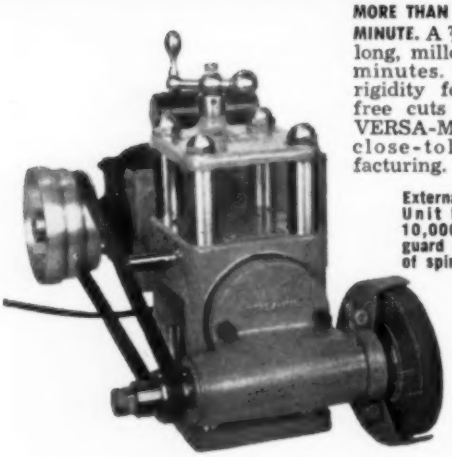
RADIAL SLOTS—CLEAN AND DEEP. Five 1/32" wide by 3/8" deep cuts milled with 90° Universal Head on the Basic Unit. Spindle may be set at any angle, at 13 speeds, and with rotation as required.



MORE THAN 1/2 CUBIC INCH PER MINUTE. A 7/8" x 7/16" slot—42" long, milled in steel in 28 minutes. The power and rigidity for fast, chatter-free cuts are built in by VERSA-MIL's design and close-tolerance manufacturing.



GRINDING I.D., O.D. AND FLAT FACE in one set up. External Grinder on the Basic Unit mounts 3" to 8" wheels, at ideal speeds, at any angle, and with reversible rotation.



External Grinder on Basic Unit has speeds up to 10,000 rpm. Wheel and guard mount on either end of spindle.

VERSA-MIL

Trade Mark

The Tool for Precision Milling, Boring and Grinding

PRODUCTION-MINDED COMPANIES LIKE THESE use one or more Versa-Mils in regular production work because it pays:

- Baldwin Locomotive Works
- General Electric Co.
- M. W. Kellogg Co.
- Otis Elevator Co.
- Fairchild Engine and Airplane Co.
- Struthers-Wells Co.
- R. Wallace and Sons Mfg. Co.
- Wright Aeronautical Corp.

Gear Tooth Crowning

(ELLIPTOID TOOTH FORM)

A CONTROLLED PRECISION MACHINING OPERATION

Gear tooth crowning (Elliptoid Tooth Form) is used for just one purpose—to prevent "end bearing," which is a concentration of operating load at the end of the tooth where it is most vulnerable to failure.

Crowning is the only way to prevent end bearing because with any gear assembly it is impossible to maintain accurate gear alignment under all conditions of loading. Shafts, bearings and mountings are all elastic. Even the slightest deflection will cause misalignment and end bearing in gears with conventional teeth.

Many of the leading automotive gear plants have standardized on crowning to raise the factor of safety of gear teeth and to reduce operating gear noise. Crowning does both successfully.

Crowning accomplished on Red Ring Gear Shaving Machines is a precision machining operation by which the maximum amount of crown is always under positive control. Tolerance control is indicated by a typical routine check of a lot of 4000 gears having the following specifications: 1″ face, 18 teeth, 13.5 Nor D.P., 20° Nor P.A., 27° H.A. and .0003″ to .0005″ crown. An adequate check failed to reveal any unit outside the .0002″ tolerance on crowning.

WRITE FOR BULLETIN S49-5 FOR A MORE DETAILED DISCUSSION OF GEAR TOOTH CROWNING

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORM

5621

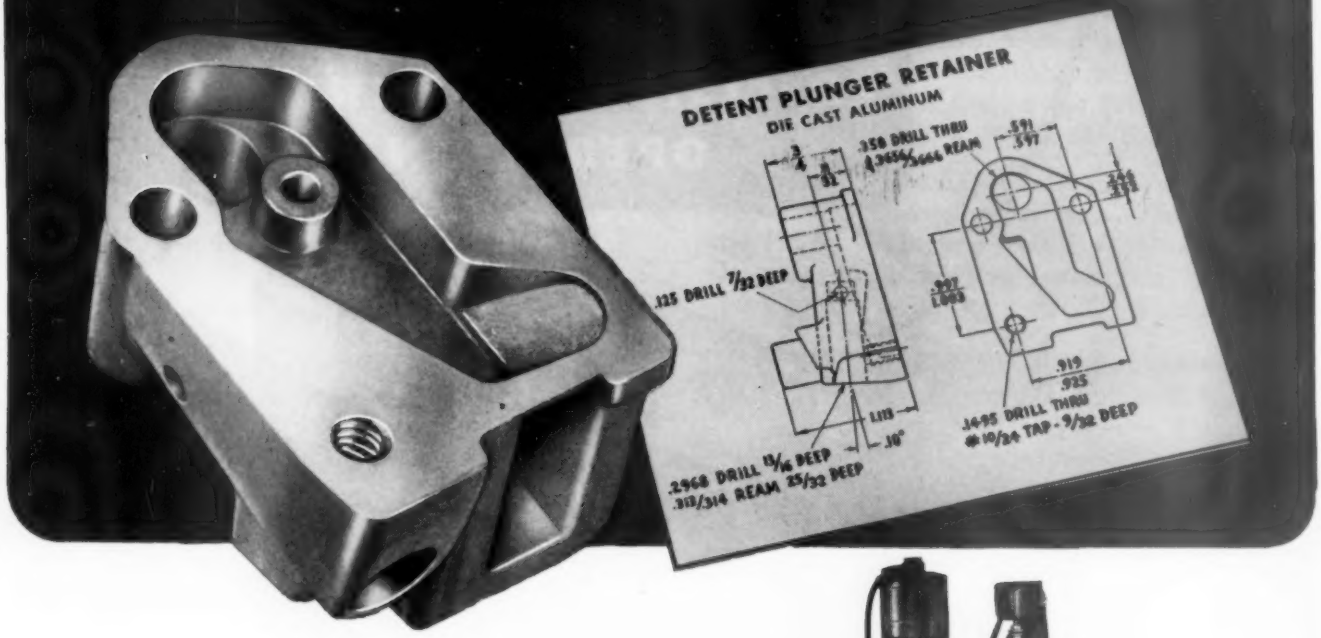
NATIONAL BROACH AND MACHINE CO.

5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

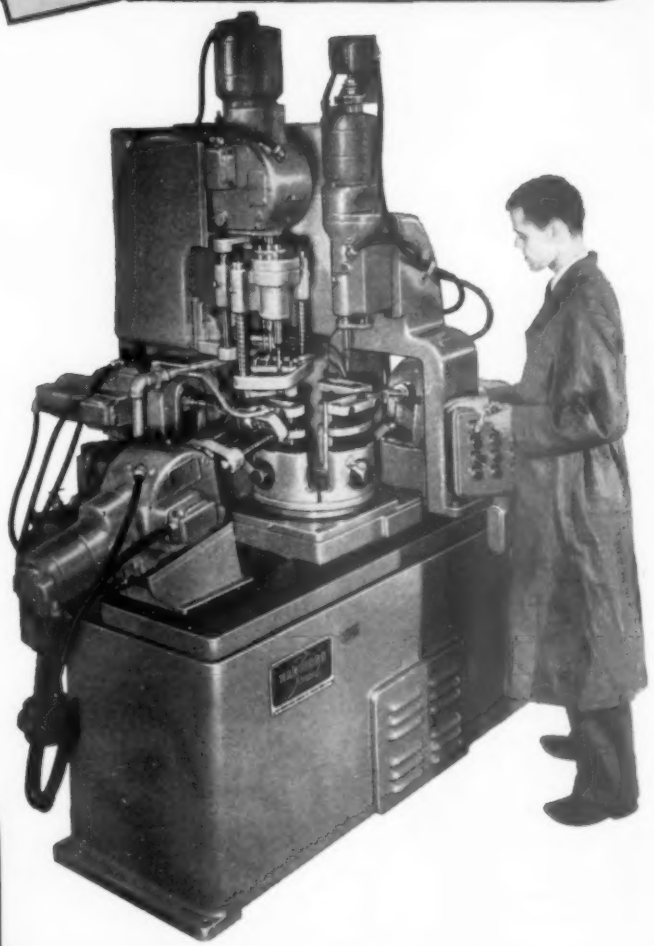
WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-147

360 PCS. PER HOUR...



drilled, reamed & tapped on this ➡ Hartford Special Automatic Drilling & Tapping Machine



HARTFORD *Special*

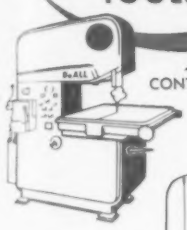
Write for New Bulletin

THE HARTFORD SPECIAL MACHINERY CO.

HARTFORD 12, CONNECTICUT

DoALL

INDUSTRY'S NEW SET OF TOOLS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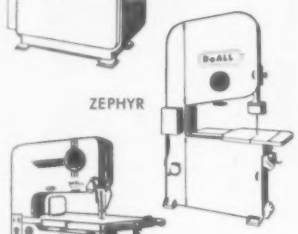
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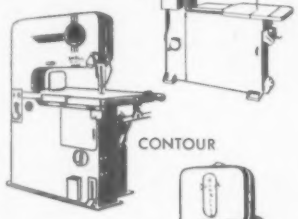
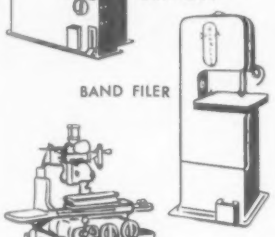
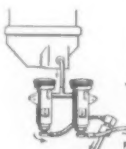
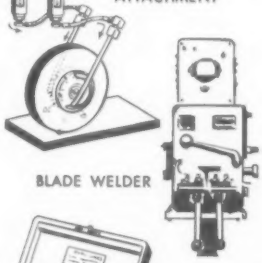

CONTOUR


BAND FILER

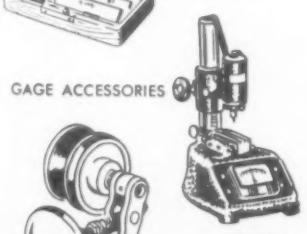
TOOLROOM GRINDER

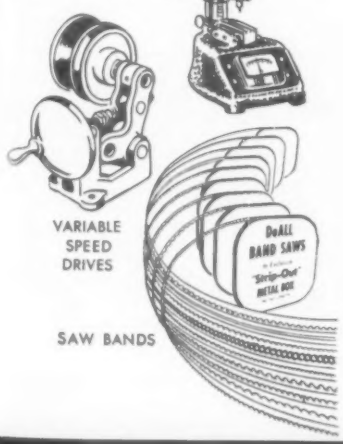
CRUSH GRINDER


"COOL GRINDING" ATTACHMENT


BLADE WELDER

GAGE BLOCKS


GAGE ACCESSORIES



VARIABLE SPEED DRIVES

SAW BANDS

ONLY GAGE BLOCKS CAN CONTROL THE DIMENSIONAL ACCURACY OF YOUR MEASURING TOOLS

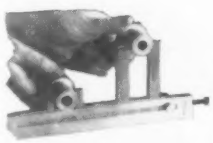
DoALL Offers:

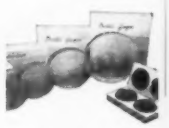
GAGE BLOCKS that are the world's finest in size, flatness, parallelism, finish, stability and hardness. We can prove these factors that give DoALL GAGE BLOCKS longer life accuracy.

INTEGRATED ACCESSORIES FOR GAGE BLOCKS expand the usefulness of your GAGE BLOCKS so that they can be assembled into everyday shop measuring tools having millionth accuracy.

A COMPLETE INSPECTION SERVICE that is prompt and inexpensive for the periodic check of the wear in your GAGE BLOCKS and their growth or shrinkage if they are of a type not fully stabilized.

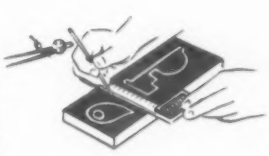
A DoALL STORE near you has a Gage Specialist at your service. Ask him to prove the superiority of DoALL Gages—and write for your free bulletin today.


Gage Block Holders


Optical Flats

Comparators

Dial Indicators


TOOL STEEL

BENCH FILER

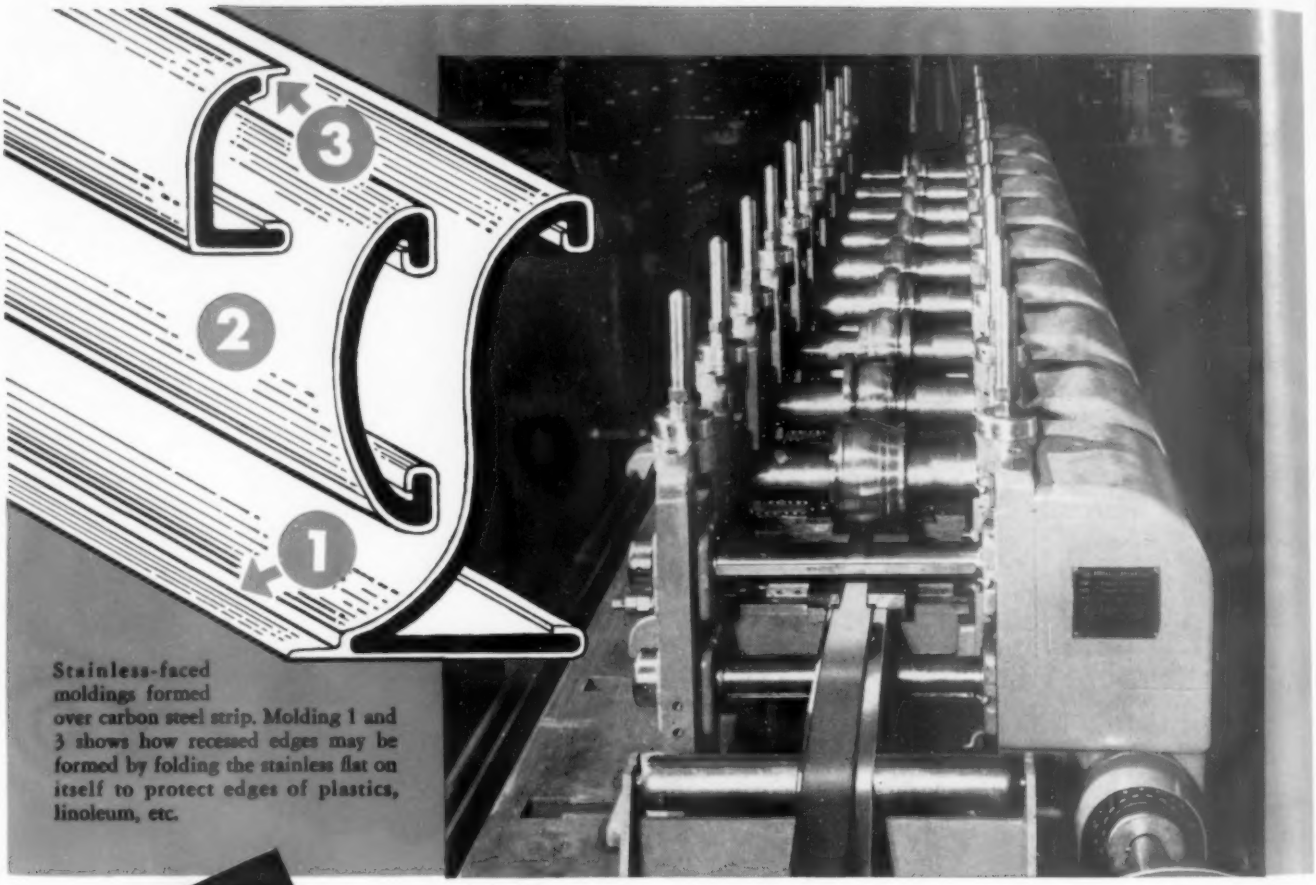
The DoALL Company

Des Plaines, Ill., U.S.A.

Cable Address: DoALL, Des Plaines

DoAll Stores In Key Cities

Factory Trained Representatives Everywhere



Stainless-faced moldings formed over carbon steel strip. Molding 1 and 3 shows how recessed edges may be formed by folding the stainless flat on itself to protect edges of plastics, linoleum, etc.

12

EXAMPLES OF ECONOMIES

effected by combining different operations in a YODER Roll Forming Production Line

No. 11. Making Stainless-faced shapes on Carbon Steel Base

One of the ads in this series showed how a new type of telephone cable was covered by aluminum and paper, and the seam sealed by injection of a viscous cement—all in one passage through a Yoder roll forming machine. Another ad showed how welding rod was made by cold forming a tube, filling it with powdered flux, cutting to length and sealing the ends in a Yoder line.

These are quite special examples, but indicative of broad possibilities. An example of more general application is the making of duplex moldings, combining a carbon steel strip (for strength) with a thin covering of stainless or non-ferrous metal, to present a beautiful, rust-resisting wearing surface.

Millions of feet of such moldings are being used annually by manufacturers of metal furniture, electric and other household appliances, food service and automotive equipment. New applications are constantly being found.

Equipment needed consists merely of two coil boxes, a Cold Roll Forming machine and an Automatic Cut-off, all standard Yoder units. As such a line will produce upwards of 30,000 feet per day, with only one operator, the conversion cost per foot is insignificant.

THE YODER COMPANY • 5525 Walworth Avenue • Cleveland 2, Ohio

Complete Production Lines

- ★ COLD-ROLL-FORMING and auxiliary machinery
- ★ GANG SLITTING LINES for Coils and Sheets
- ★ PIPE and TUBE MILLS–cold forming and welding

ENGINEERING YODER MANUFACTURING

1876 1951

MARK OF QUALITY FOR 75 YEARS

★ For three-quarters of a century this familiar trade mark has been a symbol of *quality* and *dependability.* It has been an unfailing guide to the finest tools that skill and experience can produce—Twist Drills, Reamers, End Mills, Screw Extractors, Arbors, Mandrels, Counterbores, MO-MAX High Speed Ground Tool Bits and Cut-off Blades. ◈ The demand for these tools has increased steadily throughout the years, requiring a continuous expansion of our manufacturing facilities. Today we have a total of ten acres of floor space.

THE CLEVELAND TWIST DRILL CO.

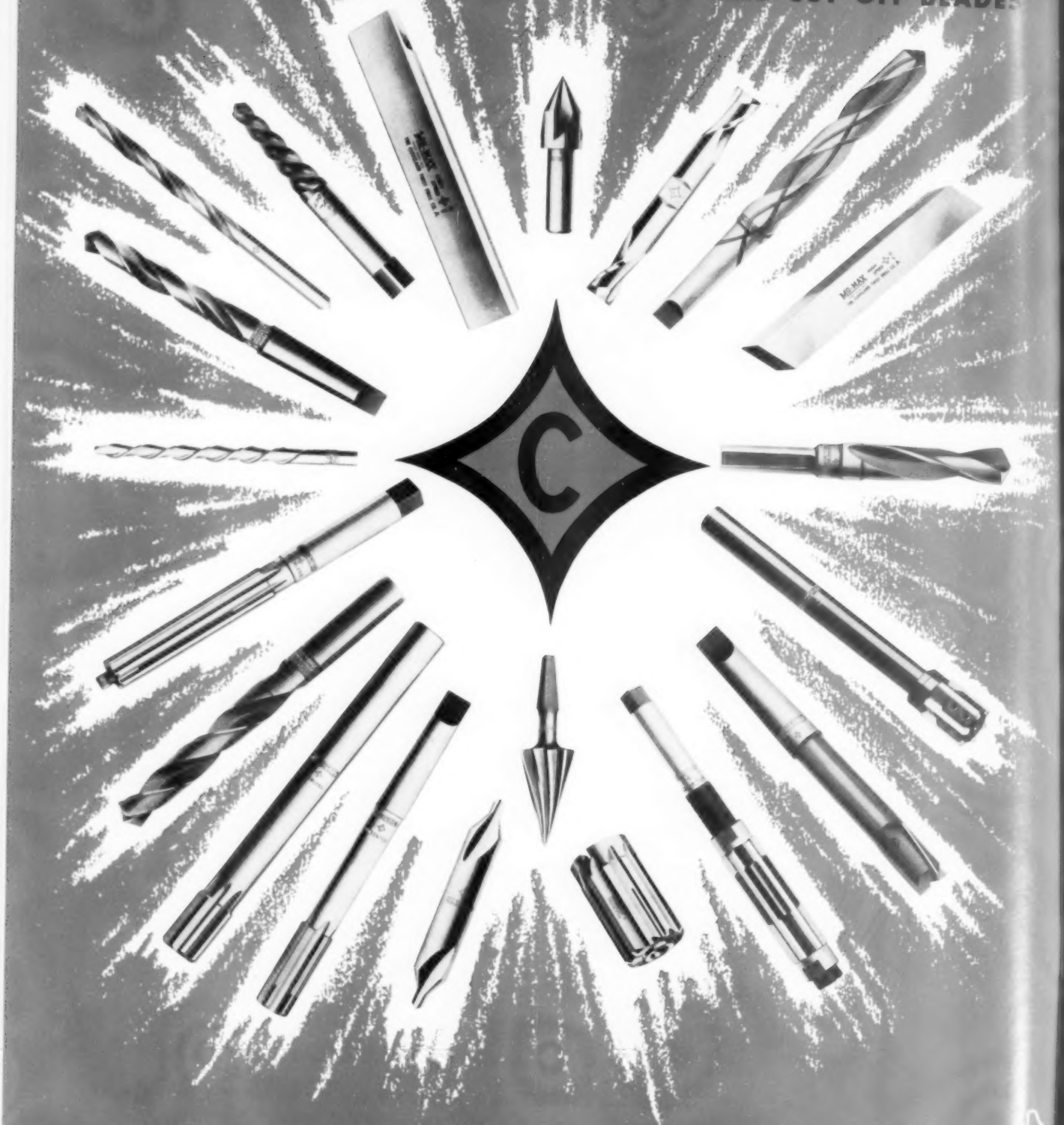
1242 East 49th Street • Cleveland 14, Ohio

Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 1 • San Francisco 5 • Los Angeles 58

E. P. Barrus, Ltd., London W. 3, England

CLEVELAND

TWIST DRILLS · REAMERS · END MILLS · SCREW EXTRACTORS
ARBORS · MANDRELS · COUNTERBORES · CARBIDE TIPPED TOOLS
MO-MAX HIGH SPEED GROUND TOOL BITS AND CUT-OFF BLADES



THE CLEVELAND TWIST DRILL CO.
1242 East 49th Street • Cleveland 14, Ohio
Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 1 • San Francisco 5 • Los Angeles 58
E. P. Barrus, Ltd., London W. 3, England

Here's the Grade-A File for Grade-A Work!

RED TANG

is the mark of the file that is *like no other file* . . . the file that is made to highest quality standards...and designed by Simonds Cutting Tool Engineers with the same easy cutting tooth as Simonds famous metal-cutting saws. Yes, this is the file that *cuts*, instead of scrapes . . . that takes off more metal with less elbow-grease...*the file that workers like.* Order *now* from your Industrial Supply Distributor.

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

Branch Offices in Boston, Chicago, San Francisco and Portland, Ore. Canadian Factory in Montreal, Que.

PRECISION BUILT ... to your blueprint

SPECIAL CUTTING TOOLS

High Speed Steel and Cemented Carbide Tipped

"BETTER" if it's made by FULLER!

SKILLED CRAFTSMEN

FULLER TOOL Co.

SPECIAL TOOLS • PRECISION MACHINING

GUILD

3956 WEST ELEVEN MILE ROAD
BERKLEY • MICHIGAN
Telephone LINCOLN 2-5600

USE READER SERVICE CARD; INDICATE A-6-154-1

How SQUARE HOLED SLEEVES SPEED UP TOOL-MAKING!

Patents Pending

One of the most difficult problems in tool making can be solved easily and quickly with Sturdy Square Holed Sleeves. The perfection of broached square holes can be had in boring bars, milling cutters and many other applications at a small fraction of the cost of imperfect hand-made square holes. The Sturdy Square Holed Sleeve consists of a round sleeve with a perfectly square hole broached through the center. This hole is tapped at one end to receive a back-up screw which is furnished with the Sleeve. The Sleeve can be sweated or pressed into a drilled and reamed hole to make a perfectly square accurate hole in a very few minutes.

The Sturdy Square Holed Sleeve will save you many hours and many dollars in the making of boring bars, tool holders and other tools requiring square holes.

BUSHINGS MADE IN FOLLOWING SIZES:
3/16, ¼, 5/16, ⅜, 7/16, ½, ⅝, ¾, 1"

•

STURDY BROACHING SERVICE
23520 TELEGRAPH RD., DETROIT 19, MICH.

Write for Literature

USE READER SERVICE CARD; INDICATE A-6-154-2

Engineering and Design Service

Let Scully-Jones experienced engineers design your dies, fixtures, gages, jigs, machines, products and cutting tools.

COMPLETE SERVICE, DESIGNING AND BUILDING METHODS ENGINEERING, PROCESSING AND DRAFTING

Write or call Bishop 7-5907 for Bulletin No. 15-50 on Scully-Jones Engineering and Design Service. It shows how S-J engineers work in your plant or ours to save you time and money.

SCULLY-JONES and COMPANY
1915 So. Rockwell St. Chicago 8, Illinois

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EFFICIENT—LOW COST PRODUCTION MEANS ROUSSELLE PUNCH PRESSES

O. B. I. PRESS

HORN PRESS

DEEP THROAT

WRITE FOR DETAILS

SERVICE MACHINE COMPANY

7627 S. Ashland Ave. • Chicago 20

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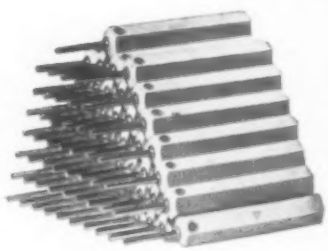
THE Van Keuren CARBOLOY WIRE TYPE PLUG GAGES



One VAN KEUREN CARBOLOY GAGE = **Fifty** TOOL STEEL GAGES

Use VK Carboloy Gages for long run jobs because of the enormous saving in gage cost.

Use VK Carboloy Gages on fussy jobs because of the infinitesimal gage wear. All parts will be within the specified limits.

VK Carboloy wire type plug gages are made to Class B accuracy, plus .00005" minus .00000" on the Go unit and plus or minus .000025" on the No Go unit. Closer or wider tolerances can be supplied if desired.

Catalog and Handbook No. 34

This 208 page volume represents 2 years of research sponsored by the Van Keuren Co. It presents for the first time in history a simple and exact method of measuring screws and worms with wires. It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods.

THE Van Keuren CO., 174 Waltham St., Watertown, Mass.

32nd YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Measuring Wires • Carboloy Plug Gages

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Columbia TOOL STEEL

CONFIDENCE—

The integrity of a supplier is of great importance in buying today's tool steel requirements.

You can have full confidence in the honesty and fair dealing of Columbia.

COLUMBIA TOOL STEEL COMPANY

ARTHUR T. CLARAGE, PRESIDENT
MAIN OFFICE AND WORKS
520 EAST 14TH. STREET • CHICAGO HEIGHTS, ILL.

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ENGRAVING • PROFILING VERTICAL MILLING

WITH THE Engravograph

TRACER-GUIDED FOR UNSKILLED LABOR

CAMS DIES DIALS PANELS

Write for literature describing:

1. Heavy Duty Engravograph (illustrated) Catalog H-41
2. Portable Engravograph — Catalog 1M-41

NEW HERMES, Inc. 13-19 University Place New York 3, N.Y.

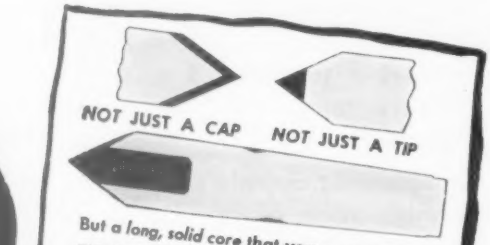
Canada: 359 St. James St., Montreal

USE READER SERVICE CARD; INDICATE A-6-155-2

Gorham "M-40-U" ALLOY CENTERS LAST THREE TO TEN TIMES LONGER

Here's a center that outlasts high speed steel and other ferrous and non-ferrous alloy centers from 3 to 10 times before it shows wear—and you can re-dress it countless times!

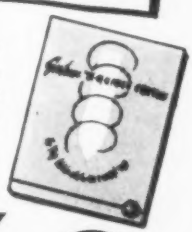
"M-40-U" is a special alloy developed by Gorham expressly for use as a wear, heat and abrasion-resistant metal. A core of this material is induction brazed in the steel shank of the center, after which the entire center is finish ground. Thus, the wear material is always supported by the tough shank steel throughout the life of the center. These centers require only a cleanup grind when wear finally occurs, and many cleanup grinds can be made without loss of wear-resistant properties, since the "M-40-U" alloy is actually a *deep core*, rather than a clad or applied *tip*.



But a long, solid core that you can re-dress many times—and get a good-as-new center every time!

Gorham "M-40-U" Alloy Centers and Half-Centers are available for immediate delivery. Morse, Jarno or Brown & Sharpe taper shanks, all popular sizes in stock, "specials" to your specification. Put an "M-40-U" Alloy Center on every lathe, automatic and grinder in your shop—watch them pay for themselves in downtime saved, *PLUS* the precision production you get with centers that stay true longer.

This Gorham center folder gives full description, dimensions and prices. Send for your free copy today.



Gorham TOOL COMPANY

"EVERYTHING IN STANDARD OR SPECIAL CUTTING TOOLS"

14407 WOODROW WILSON • DETROIT 3, MICHIGAN

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-155-3

HERE'S HELP FOR YOUR CARBIDE TOOLMAKER

. . . his big problem today is getting the best carbide to do your job!

. . . BEST *for performance*
. . . BEST *for availability*
. . . BEST *for price*

● **Think twice when indicating your carbide grade specification . . . don't limit your carbide toolmaker to a brand or grade of carbide which is unavailable or not *best* suited for your job.**

Independent carbide toolmakers have found through years of experience that ADAMAS enables them to turn out better tools on a faster delivery schedule. The availability of a complete line of standard and special tips in *work-proved* grades has made them eager to use ADAMAS tungsten carbide.

Specify an ADAMAS grade on your next job and have the advantages of ADAMAS *quality, delivery and price.*

YOU CAN HELP YOUR CARBIDE TOOLMAKER BY SPECIFYING

ADAMAS

The revised ADAMAS "Carbide Manufacturers' Grade Recommendations" showing grade recommendations of all carbide manufacturers will help you in selecting the proper tungsten carbide for your job. Write for your FREE copy.

ADAMAS
CARBIDE CORPORATION
Harrison, New Jersey

Producers of top quality carbide for cutting tools, dies and wear resistance.

ADAMAS CARBIDE CORPORATION
Dept. A, Harrison, New Jersey

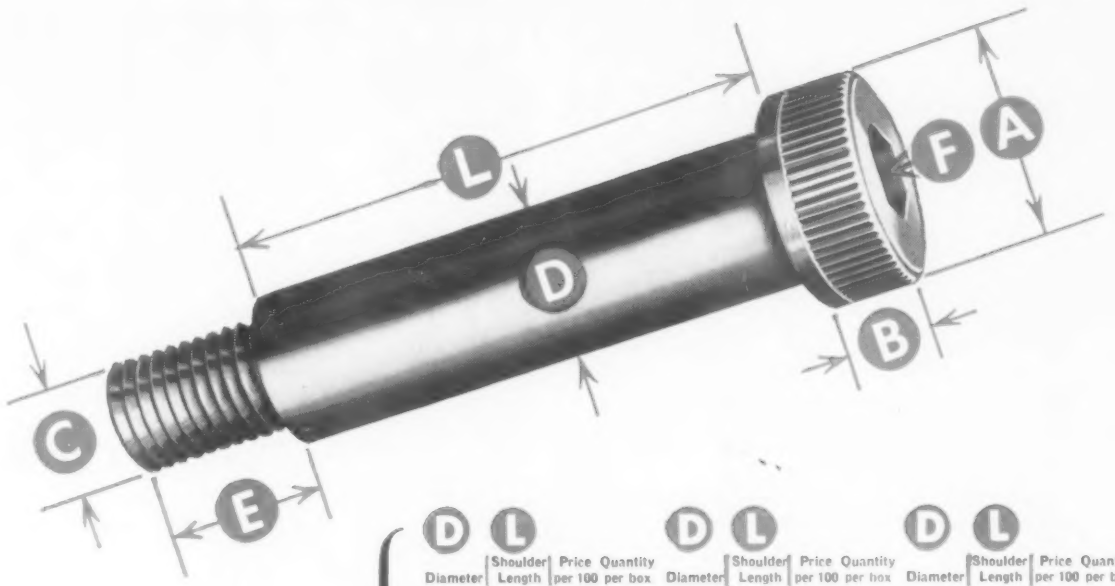
Please send me FREE your "Carbide Manufacturers' Grade Recommendations."

Name . . . . . .
Company . . . . . .
Address . . . . . .
City . . . . . Zone . . . . . State . . . . . .

"STANDARD" recommends STANDARDS*

UNBRAKO®

SHOULDER SCREWS OR STRIPPER BOLTS



These UNBRAKO Screws have shoulders held to close tolerances . . . finished threads close to the shoulder . . . threads and heads concentric with the body.

They are preferred by die-makers everywhere, but are also used for linkage, trunnion mountings, shafts and numerous other applications throughout industry.

★ **One of a series listing *Standard* UNBRAKO Socket Screw Products sold by your local UNBRAKO Distributor. If you want reprints of this and other advertisements in the series, ask for them on your business letterhead.**

D Diameter	L Shoulder Length	Price per 100	Quantity per box
1/4	1	16.00	25
	1¼	16.75	25
	1½	17.50	25
5/16	1	17.00	25
	1¼	17.75	25
	1½	18.50	25
	1¾	19.25	25
	2	20.00	25
3/8	1	19.00	25
	1¼	19.75	25
	1½	20.50	25
	1¾	21.25	25
	2	22.00	25
	2¼	23.50	25
	2½	25.00	25
	2¾	26.50	25
	3	28.00	25
	3¼	30.50	25
	3½	33.00	25
	3¾	35.50	25
	4	38.00	25
1/2	1	29.00	25
	1¼	29.75	25
1/2	1½	30.50	25
	1¾	31.25	25
	2	32.00	25
	2¼	33.50	25
	2½	35.00	25
	2¾	36.50	25
	3	38.00	25
	3¼	40.50	25
	3½	43.00	25
	3¾	45.50	25
	4	48.00	25
	4¼	52.00	25
	4½	56.00	25
	4¾	60.00	25
	5	64.00	25
5/8	1¼	42.75	25
	1½	43.50	25
	1¾	44.25	25
	2	45.00	25
	2¼	48.00	25
	2½	51.00	25
	2¾	54.00	25
	3	57.00	25
	3¼	61.00	25
	3½	65.00	25
5/8	3¾	69.00	25
	4	73.00	25
	4¼	78.00	25
	4½	83.00	25
	4¾	88.00	25
	5	93.00	25
	5½	108.00	25
	6	123.00	25
3/4	1½	68.50	25
	1¾	69.25	25
	2	70.00	25
	2¼	73.00	25
	2½	76.00	25
	2¾	79.00	25
	3	82.00	25
	3¼	87.00	25
	3½	92.00	25
	3¾	97.00	25
	4	102.00	25
	4¼	108.00	25
	4½	114.00	25
	4¾	120.00	25
	5	126.00	25
	5½	144.00	25
	6	162.00	25

Prices subject to change without notice.

LIST PRICES SUBJECT TO DISCOUNT

Stripper Bolt Dimension
Class 3 Fit is an "Unbrako" Standard

D Shoulder Diameter	¼	5/16	3/8	½	5/8	¾
C Thread Diameter	10–24	¼–20	5/16–18	3/8–16	½–13	5/8–11
E Thread Length	3/8	7/16	½	5/8	¾	7/8
A Head Diameter	3/8	7/16	9/16	¾	7/8	1
B Head Height	3/16	7/32	¼	5/16	3/8	½
F Size of Hex. Hole	1/8	9/32	3/16	¼	5/16	3/8

SPS

STANDARD PRESSED STEEL CO.

JENKINTOWN 37, PENNSYLVANIA

Before specifying "specials"—study UNBRAKO *standards*.

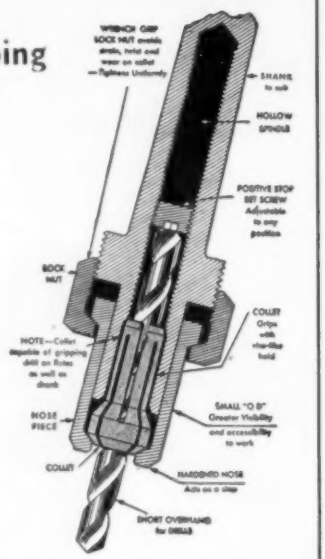
"More Holes Per Grind" with the ERICKSON Precision Collet Chuck

BECAUSE IT

Permits Drill Stubbing

- **Reduces Down Time and Drill Breakage**
- **Holds Hole Sizes.**

To get maximum efficiency and full life from a drill, it is essential that cutting edges cut equally. Edges can only cut equally when the drill is held rigid and concentric. When you can guarantee this condition you get "more holes per grind." The Erickson Precision Collet Chuck *does* guarantee this condition. Chuck accuracy of .0005 TIR is guaranteed, insuring maximum concentricity in the drill. Stubbing gives a short, rigid column, reducing stress. Users report up to 85% less drill breakage with the Erickson Collet Chuck.


SHANK to suit
HOLLOW SPINDLE
POSITIVE STOP SET SCREW Adjustable to any position
SOCK NUT
COLLET Grips with even-like hold
NOTE—Collet capable of gripping drill on flutes as well as shank
SMALL "O.D." Greater Visibility and accessibility to work
NOSE PIECE
COLLET
HARDENED NOSE Acts as a stop
SHORT OVERHANG for DRILLS

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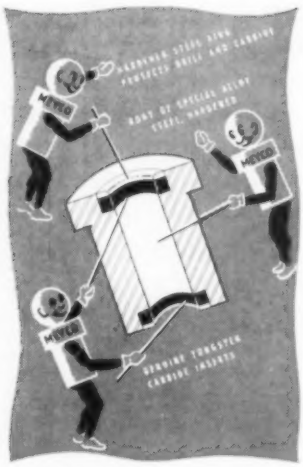

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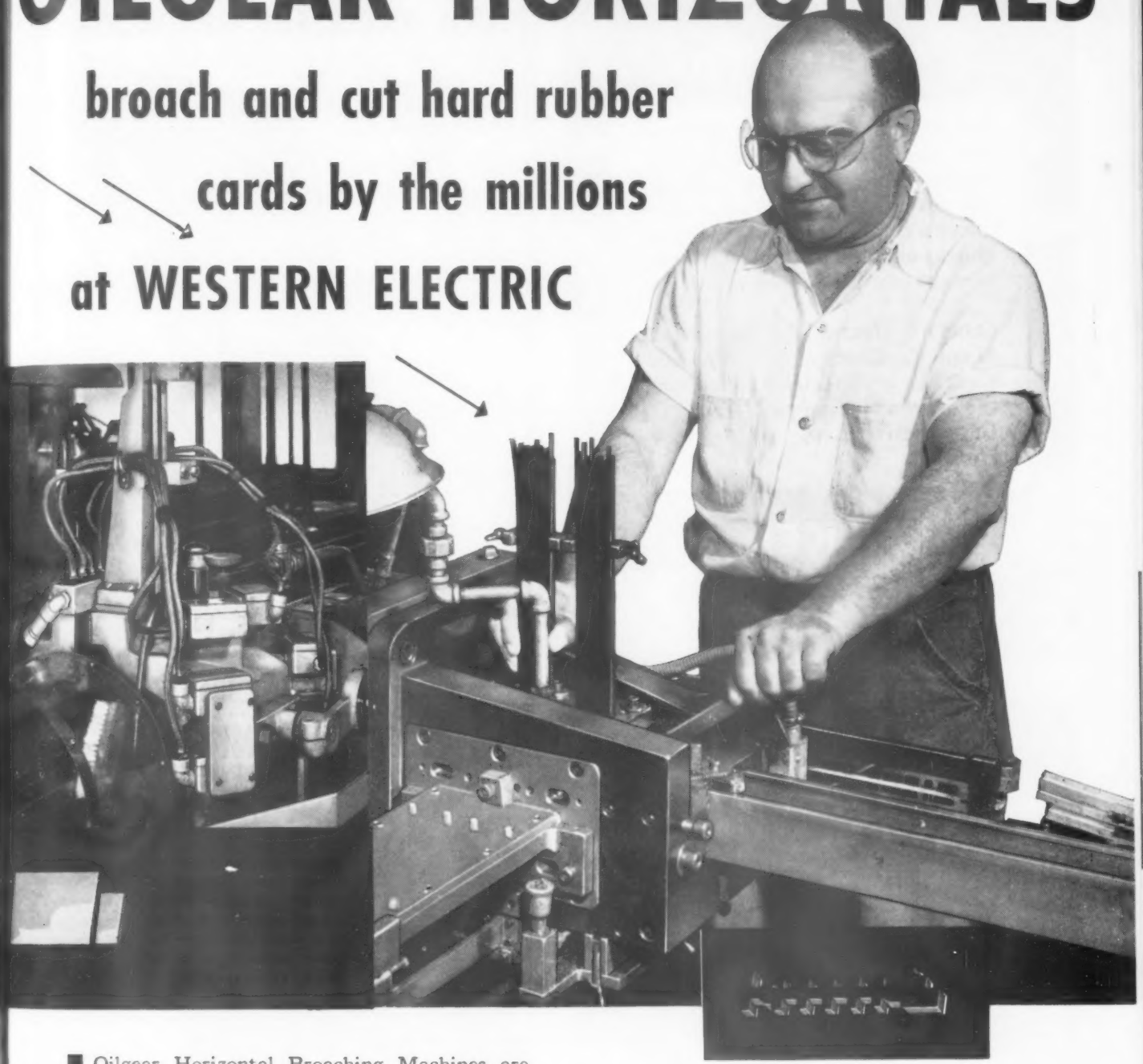
broach and cut hard rubber cards by the millions at WESTERN ELECTRIC



■ Oilgear Horizontal Broaching Machines are used by Western Electric in the broaching and cutting of separators or operating "cards" from hard rubber stock. Used by the millions annually in dial telephone exchanges, these cards must meet precision contour requirements.

A battery of four Oilgear XL-6 x 48″ stroke horizontal broaching machines is used to form-broach and cut these hard rubber cards. Each Oilgear Horizontal broaches and cuts 50 cards in a single pass from bundles of strips (1/16″ x ¼″ x 23⅜″) that are ground on each side to accurate dimensions. Each machine has a capacity of 12 to 13 million cards per year. These Oilgear Horizontals have been in service a number of years. Elsewhere, Oilgear Horizontals are used to broach and shape similar parts from phenolic stock.

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BROACHING MACHINES AND PRESSES

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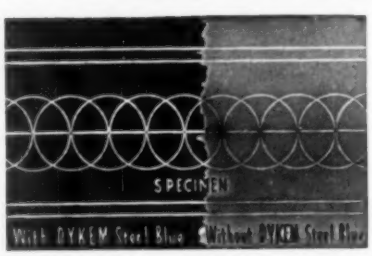

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FOR HIGH SPEED CUTTING OF SOFT NON-FERROUS METALS
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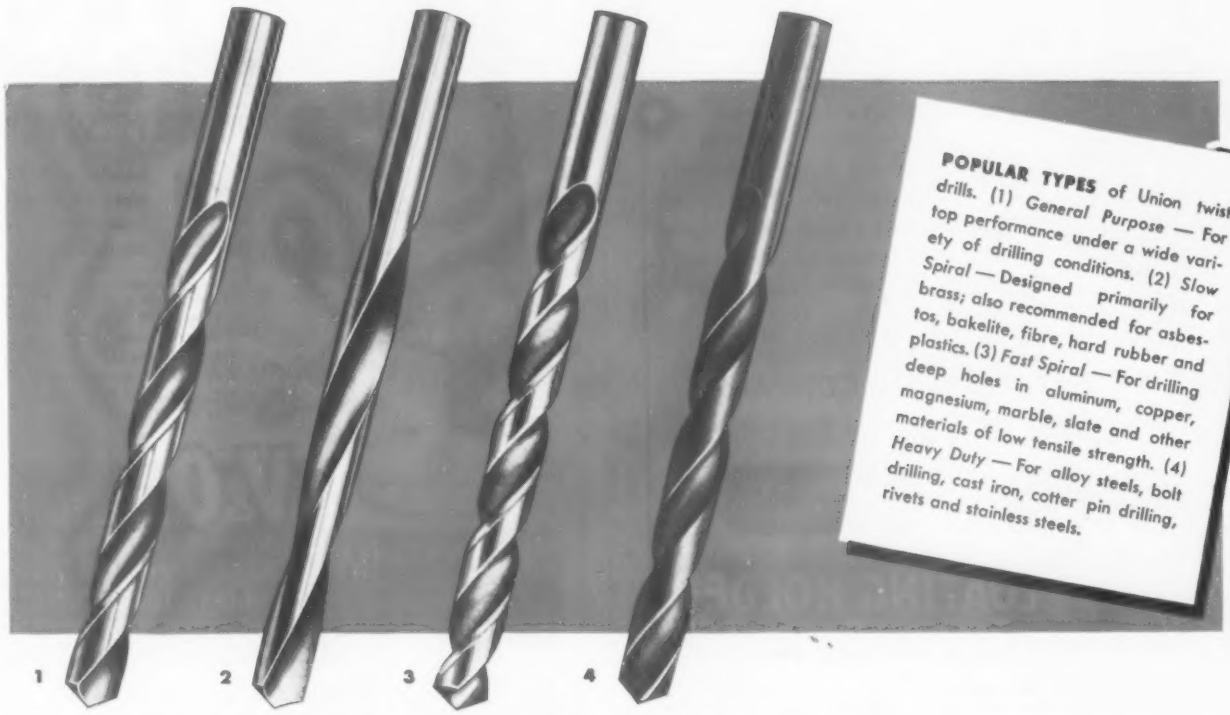
Your order is in for top performance...

when you specify UNION *twist drills*



POPULAR TYPES of Union twist drills. (1) *General Purpose* — For top performance under a wide variety of drilling conditions. (2) *Slow Spiral* — Designed primarily for brass; also recommended for asbestos, bakelite, fibre, hard rubber and plastics. (3) *Fast Spiral* — For drilling deep holes in aluminum, copper, magnesium, marble, slate and other materials of low tensile strength. (4) *Heavy Duty* — For alloy steels, bolt drilling, cast iron, cotter pin drilling, rivets and stainless steels.

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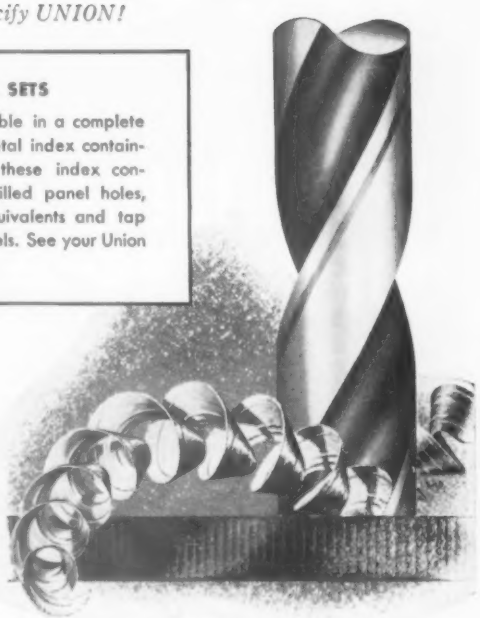
Union twist drills are available in a complete line of sets, together with metal index containers. Valuable time-savers, these index containers have individually drilled panel holes, with drill sizes, decimal equivalents and tap sizes plainly marked on panels. See your Union distributor for full details.



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contact your local distributor

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- SPINNING
- MILLING
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Anti-Friction Bearings—High Speed—Carbide
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2 at a time with the
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FREE CATALOG contains valuable engineering information and rivet specifications plus illustrated descriptions of 26 Chicago Automatic Rivet Setters.

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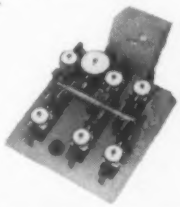
NEW FEDERAL DIMENSIONAIR — outstanding wide range (.003") reads .00005" directly, exceptionally stable, faster to set.



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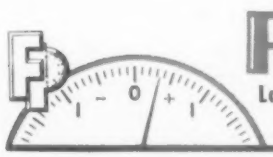

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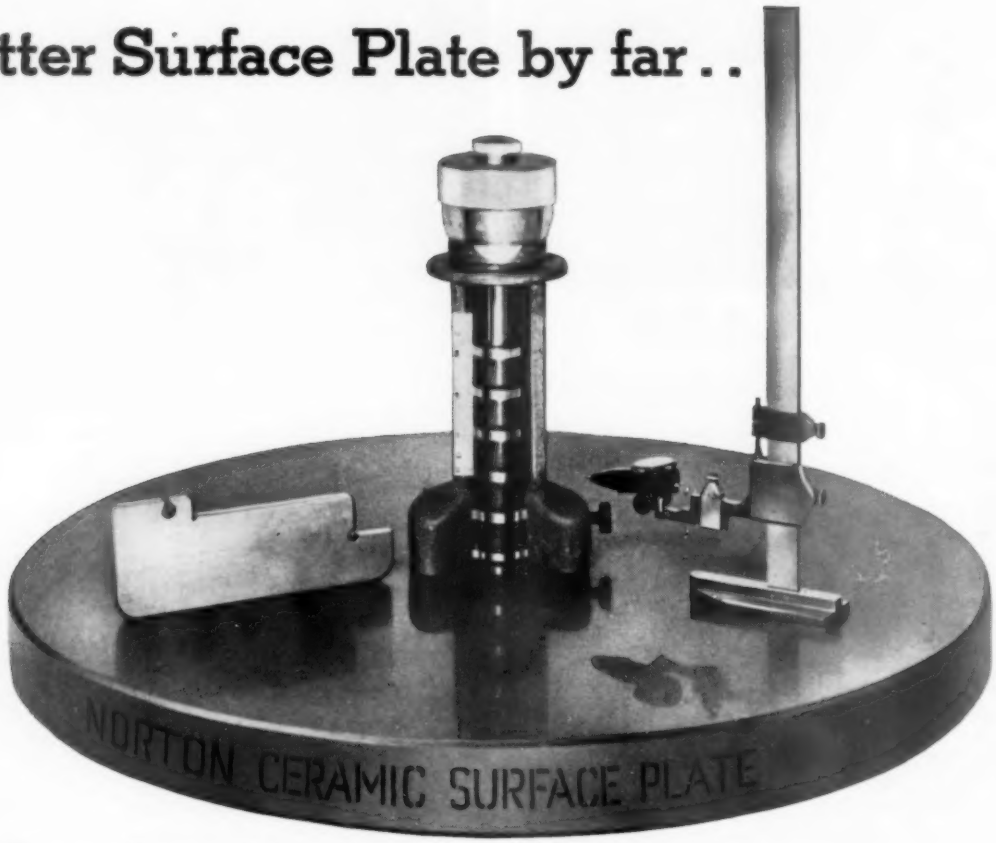
A Better Surface Plate by far . .



Better by far . . .

because it has so many superior qualities

CHECK THESE IMPORTANT QUALITIES and you'll see how Norton Ceramic Surface Plates will speed up precision checking and cut costs in your plant.

☑ ***LONG LIFE*** is guaranteed for these wear-resistant plates which are made of a material harder than any other type of surface plate. Laboratory and field tests proved wearability was 40 to 1 over best competing type.

☑ ***PRECISION FLATNESS*** of the Norton Ceramic Surface Plate has been found preferable for precision checking operations. Made of a durable and stable material, the ceramic plate stays flat. It will not warp or deform; it will not deflect under load.

☑ ***LESS WEAR OF EXPENSIVE INSTRUMENTS,*** gage blocks and sine bars has proved to be another cost-saving-feature of these ceramic surface plates. The continuously smooth surface allows easy movement of instruments and work across the plate.

☑ ***NON-CORROSIVE.*** The Norton Ceramic Surface Plate will never sweat nor corrode. It does not require greasing or protection from moisture.

☑ ***NON-MAGNETIC*** quality of these ceramic surface plates often proves to be another time-saving feature.

☑ ***LIGHT WEIGHT*** of Norton surface plates permits easy mobility from one checking operation to another. These plates can be finished both sides and their lightness permits easy turning for double utility.

☑ ***BETTER FOR BLUEING.*** The light colored surface of the Norton Ceramic Surface Plate reflects light better for blueing than do dark plates. The special surface texture permits a uniform film to be transferred from plate to work. The blueing mix spreads easily, is moist longer.

☑ ***LOWER MAINTENANCE COSTS*** are obviously the result of using these extremely wear-resistant plates which retain their precision surface finish through years of daily, severe use. The plate is easily cleaned with soap powder and water.

☑ ***CENTER HOLE FOR GAGE SHANK.*** The larger sizes of the Norton Ceramic Surface Plate are made with a center hole which in many checking operations is used to hold the gage shank or center post.

☑ ***FASTER, MORE ACCURATE READINGS*** can be obtained with this ceramic surface plate because the precisely flat and smooth surface permits accurate, duplicate readings to be made quickly.

NORTON COMPANY
Worcester 6, Massachusetts

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NORTON

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Super

CARBIDE TIPPED

REAMERS

in a complete range of types and sizes carried in stock to simplify your tooling job.

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QUALITY CARBIDE TOOLS

Super TOOL COMPANY

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JUNE, 1951

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Phone: Plaza 9-4018
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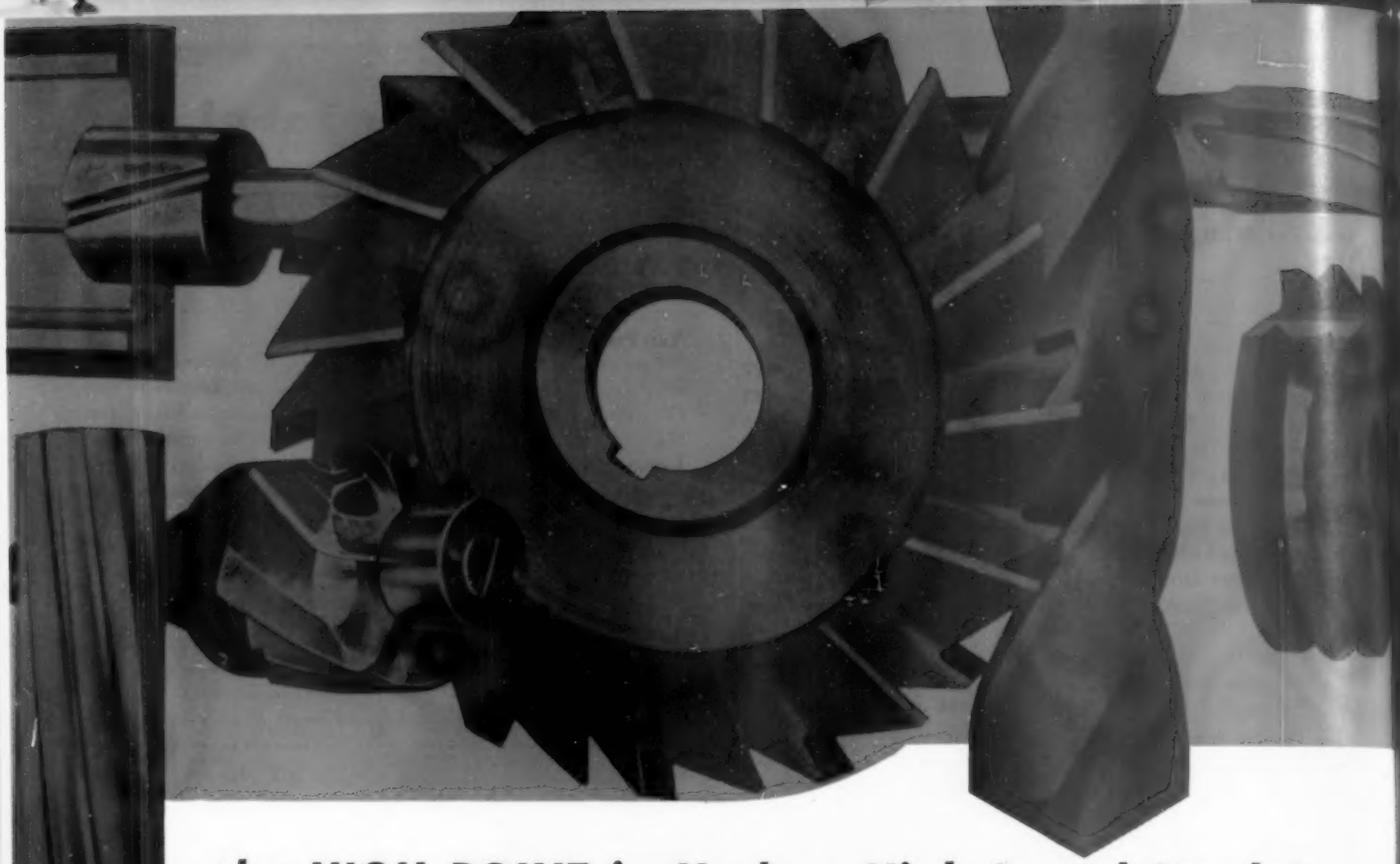

the HIGH POINT in Modern High Speed Steels!

VASCO SUPREME

When you have high production requirements or materials to cut that are difficult to machine, you'll do better with SUPREME! Let us have our experts guide you in its use.

SUPREME Performance Facts

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NOTE: Vasco Supreme A—a Class A steel—is not restricted by Limitation Order M-30.

Vasco Supreme and Vasco Supreme A steels developed by Vanadium-Alloys Steel Co. are fully covered by U. S. Patents 2174285 and 2174286. Beware of unlicensed imitations.

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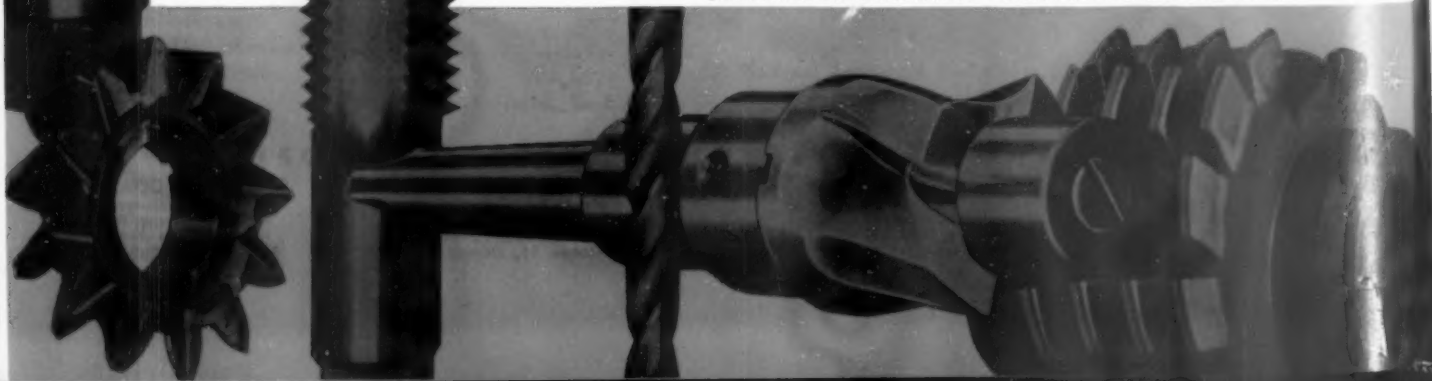
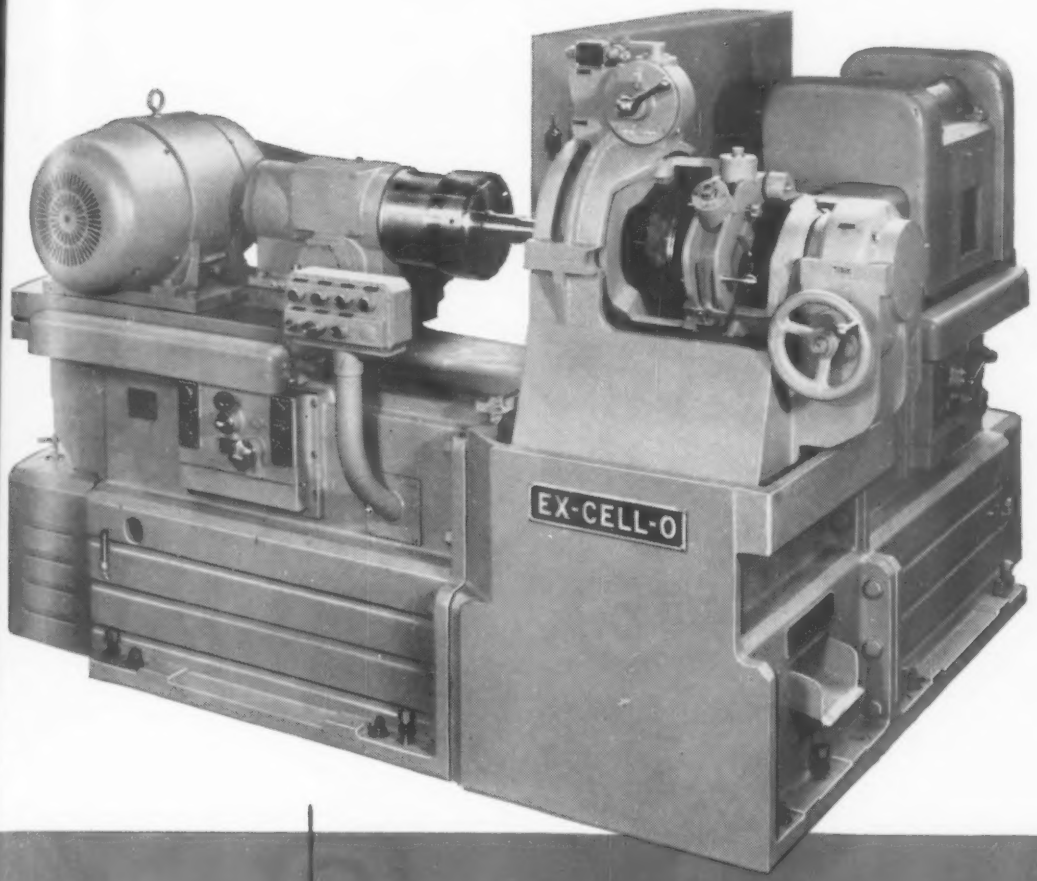
STEEL COMPANY
LATROBE, PA.

COLONIAL STEEL DIVISION • ANCHOR DRAWN STEEL CO.





Ex-Cell-O Two-Way Precision Boring Machine, with fixture that accommodates two- and three-cylinder in-line refrigerator compressor blocks; four- and six-cylinder V-type blocks.

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EX-CELL-O *for* PRECISION

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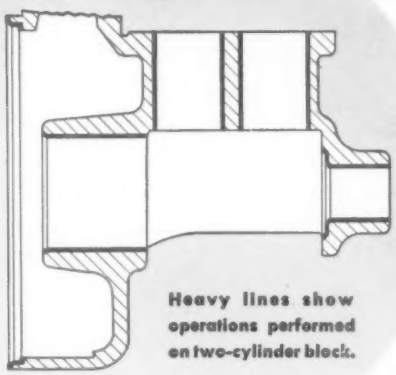
WAY MACHINE BORES CYLINDERS AND CRANK BEARINGS SIMULTANEOUSLY



Heavy lines show operations performed on two-cylinder block.

ACCURACY OF 90° ANGLE IS BUILT INTO MACHINE

This Ex-Cell-O Way Machine precision bores cylinders and crankshaft bearings of refrigerator compressor bodies, holding a 90° angle between the bores within .001″ in 14″. When operations from two directions are performed on one machine the possibility of error in relocating and reclamping the part for each operation is eliminated. Thus the accurate relationship of one operation to another is built into the machine. And of course, doing the operations simultaneously saves time and money too.

Ex-Cell-O Way Type Precision Boring Machines are built up by combining standard way units with a center section and adding tooling to fit the job. Standard way units are economical, self-contained, and can be used over and over again in different combinations. For full information, contact your local Ex-Cell-O representative, or write Ex-Cell-O in Detroit today.

EX-CELL-O

CORPORATION
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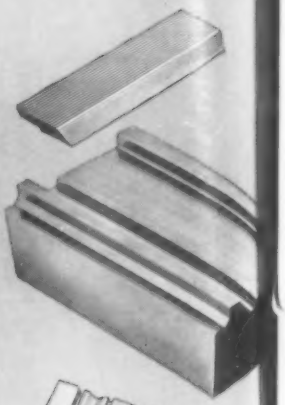
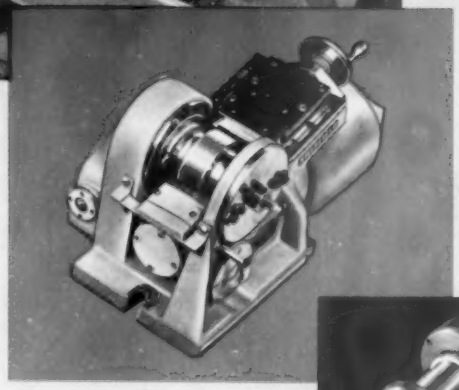
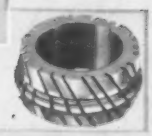
Equip for Crushtrue Grinding to Speed Production and Cut Costs







You can produce the kind of work shown here faster and more economically with Sheffield Crushtrue Dressing Devices, and Crushtrue Dressing Rolls.

Dressing the grinding wheel by Crushtrue equipment (1) is very much faster than diamond dressing, (2) increases the cutting capacity of the wheel, (3) greatly reduces generated heat in grinding, (4) minimizes the tendency of the wheel to "load up" (5) reduces the actual grinding time as much as 75%.

Idler, Motorized and Self-truing Crushtrue Devices are available. Your selection will depend upon the work you do and the grinding equipment you have.

Crushtrue rolls for standard threads can be shipped immediately from a Sheffield "bank." Rolls for special forms for users engaged in long run production schedules can also be included in this stock on hand. Users send in rolls to be reground and immediately replacements from Sheffield's bank are forwarded at nominal cost. This relieves the user from the expense of ever having to buy new rolls.

Write for information on the Sheffield "Crushtrue Roll Bank" and specifications on these Crushtrue Devices.

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